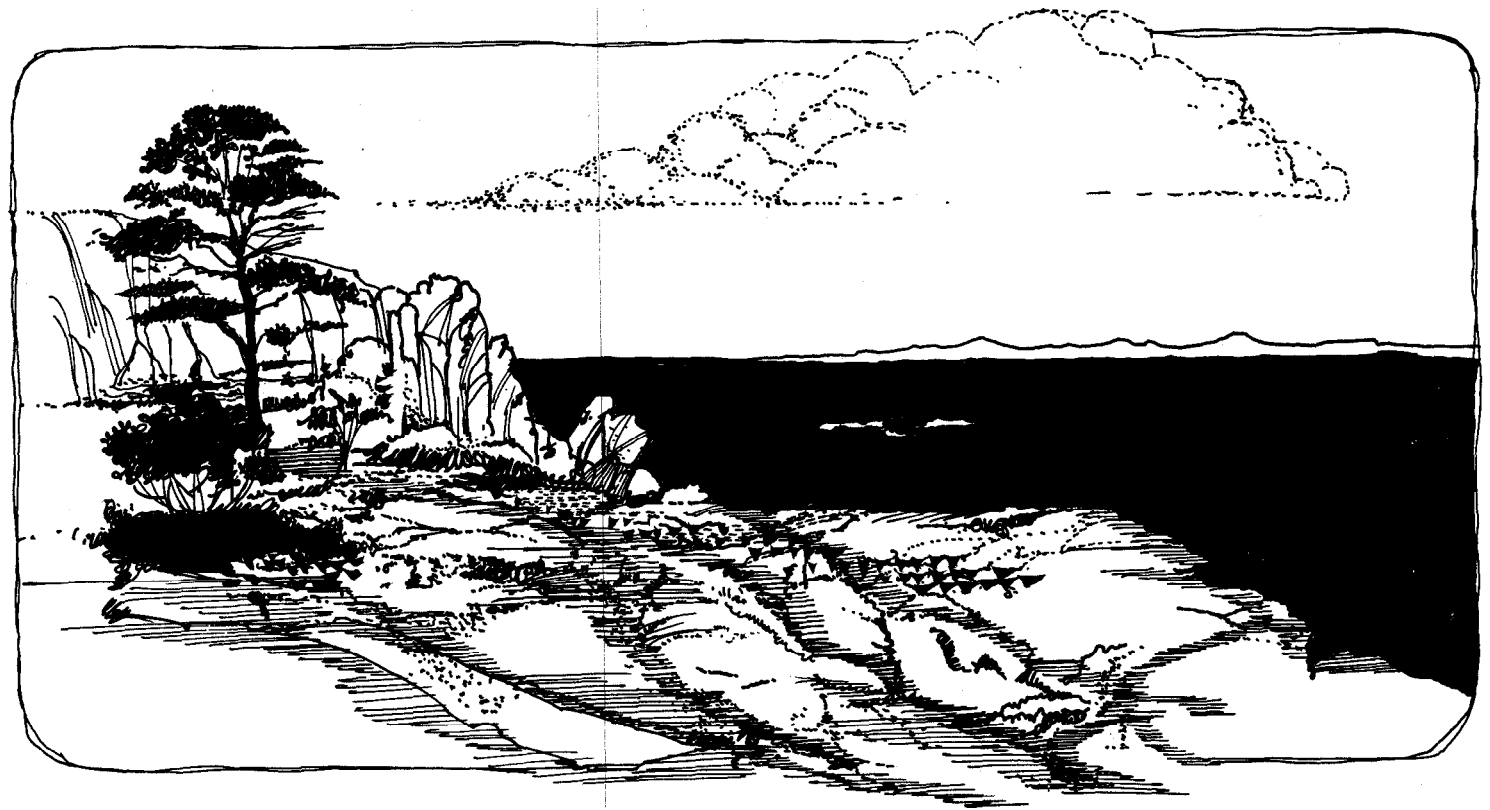


general management plan  
environmental assessment  
wilderness suitability study



**El Malpais National Monument**  
New Mexico

general management plan/environmental assessment  
wilderness suitability study

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draft  
january 1990

**EL MALPAIS NATIONAL MONUMENT . NEW MEXICO**

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**UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE**

## Dear Reader,

Congress established the El Malpais National Monument and National Conservation Area near Grants, New Mexico, with the passage of Public Law 100-225 on December 31, 1987. The national monument contains about 114,000 acres and is managed by the National Park Service. The national conservation area contains about 262,000 acres and is managed by the Bureau of Land Management.

In addition to designating these areas, Congress provided some direction as to how they should be managed and mandated that a general management plan be written for each. Each agency has selected a planning team, and the teams have gathered as much information as possible, consulted with professionals from other government and nongovernment sources and with each other, held public meetings, solicited written and verbal comments, and talked with American Indian groups.

With all this input in mind, each agency has now written a *Draft General Management Plan*, which is ready for review and comment. This document is the draft plan and environmental assessment for the national monument. The plans present the following:

- . The condition of the land and its resources.
- . The proposals for meeting the legislative mandates, enabling visitors to experience the significant features and providing protection for the resources.
- . The feasible alternatives for managing these areas.
- . The impacts of implementing the proposal and the alternatives.

You will find both differences and similarities in the two general management plans. The differences occur because the National Park Service and the Bureau of Land Management have different missions and functions.

The National Park Service promotes and regulates the use of national parks and monuments to conserve the scenery, the natural and historic objects, and the wildlife, and provides for the enjoyment of these things in such a way that future

generations can enjoy them. The general management plan is presented in terms of visitor use areas.

The Bureau of Land Management actively manages public land resources, including those of the national conservation area, to meet the full spectrum of public needs. This management is done in a way that ensures the resources will continue to be available predictably in the future. The Bureau of Land Management's challenge in the national conservation area is to provide for a multitude of uses (such as grazing, home-use woodcutting, recreation, wildlife, wilderness, and cultural values) while preserving the values for which the conservation area was established. The general management plan is described in terms of resource-based management units.

The two plans are similar in that both agencies are concerned with protecting the resources of the El Malpais area, both offer a "preferred" plan and alternative for managing the land under their jurisdiction, and both are committed to responding to American Indian concerns for managing the land. Both plans contain sections on managing cultural resources, natural resources, wilderness, and developing visitor facilities.

Previous public involvement has been the basis for identifying the issues that are addressed in these draft general management plans. These plans, which are submitted for your review and comment, are the next important step in involving the public in the management of these two areas. We now need your written comments and ideas on these draft plans to formulate specific approaches to dealing with the issues previously identified. Public meetings will also be held during the public review period to allow for public comments. Comments on this Park Service *Draft General Management Plan* should be sent to the address below.

National Park Service  
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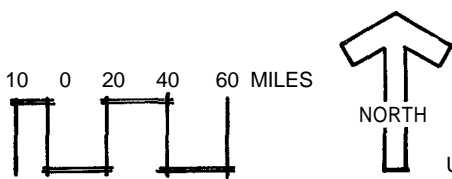
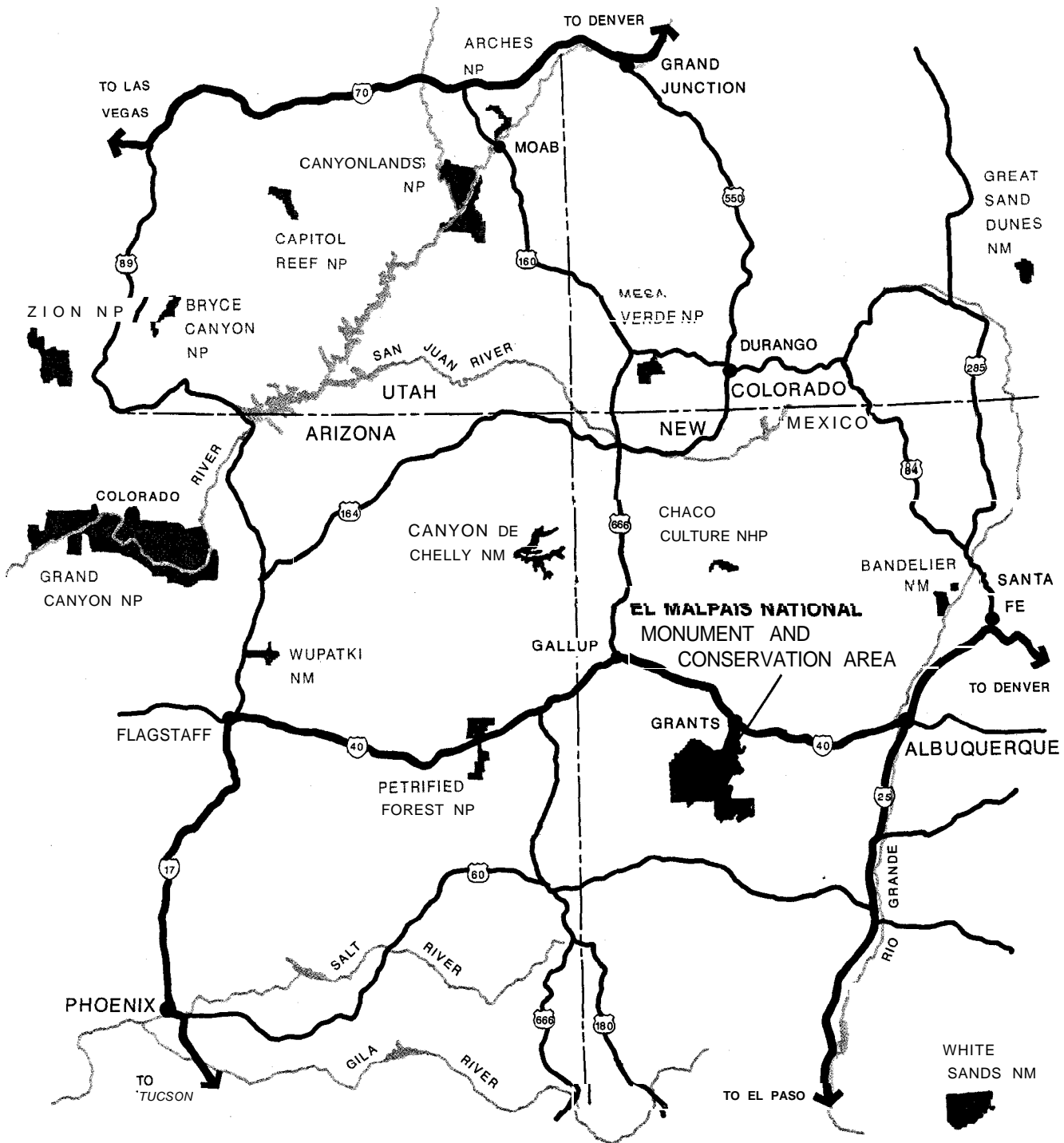
## INTRODUCTION

As of December 31, 1987, El Malpais National Monument is a newly established area of the national park system (see Region map). Most of the monument, about 114,992' acres in northwestern New Mexico, is volcanic terrain and includes some of the most recent lava flows in the continental United States. "El Malpais" means "bad lands." This rugged area contains fragile biotic and cultural resources, the latter comprising a record of human occupation that extends from the distant past to the present and marking occupation by several prehistoric and contemporary Indian cultures. The significance of the cultural and natural resources is only partly known and requires that planning for visitor use be conducted with sensitivity and constraint. The monument has few existing facilities for visitors, and public use, except at a commercial ice cave, has been sparse.

The land in El Malpais National Monument has deep special meaning to the American Indians in the area, especially the **Acoma**, **Laguna**, **Ramah** Navajo, and Zuni tribes. During planning, Indian interests, including religion, were frequently considered; it was quite apparent that El Malpais and the American Indian people who have occupied and used it for millennia are closely intertwined. The planning team has made a concerted effort to understand this and plan in a way that would help visitors understand this special aspect of El Malpais.

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1. Acreage figures are still in the process of being refined; future figures may deviate slightly from the acreages given in this document.



**REGION**  
**EL MALPAIS NATIONAL MONUMENT**  
U.S. DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE  
DSC/JULY 19891103120.003

## PURPOSE OF AND NEED FOR THE PLAN

A general management plan is needed to establish and guide the overall management, development, and use of the monument for approximately the next 15 years. The primary focus is to protect and preserve the natural and cultural environments; to permit biological, geological, and other natural processes to continue with a minimum of human intervention; to provide opportunities for enjoyable visitor experiences as well as an understanding of the significance of monument resources; and to consult with American Indians on matters of access, development, interpretation, and protection of resources. In the general management plan process, legal requirements, constraints, and problems must be taken into account. These requirements, constraints, and major planning issues are described below; the alternative solutions are addressed later in this document.

## REQUIREMENTS, ISSUES, AND CONCERNS

### Meeting Legislative Requirements

100-225 establishing El Malpais National Monument and El Malpais National Conservation Area (see appendix A) directs the National Park Service (NPS) and the Bureau of Land Management (BLM) to complete general management plans for the two areas by September 30, 1991. The legislation identifies several other conditions that must be satisfied in the general management plans. They are as follows:

The purpose of the monument and conservation area is "to preserve, for the benefit and enjoyment of present and future generations, the area in western New Mexico containing the nationally significant Grants Lava Flow, the Las Ventanas Chacoan Archeological Site, and other significant natural and cultural resources." The secretary of the interior, through the director of the National Park Service, shall manage the monument in accord with the provisions of the El Malpais Act, the act of August 25, 1916

(which established the Park Service), and other laws applicable to units of the national park system. Consistent with the 1916 act, the secretary shall administer the monument for the purposes of preserving the scenery and the natural and cultural resources of the monument and providing for public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

Grazing privileges within the monument that are of a fixed term or scheduled for termination before December 31, 1997, are to be continued only temporarily, subject to proper range management; grazing privileges will be discontinued completely on federal lands within the monument on January 1, 1998.

The El Malpais Act authorizes designation of the Masau Trail, a vehicular tour route on existing public roads that links cultural sites in New Mexico and eastern Arizona. El Malpais National Monument is one of seven units linked by the trail, and the secretary of the interior (through the Park Service) is authorized to add other sites of national cultural importance that are protected by federal, state, and local governments, Indian tribes, or nonprofit entities. Informational material is to be distributed along the trail, and the trail will be marked with appropriate markers to guide the public.

### acquisition

other interests by donation, purchase, exchange, or transfer. Specific conditions

federal mineral interests, and the Pueblo of **Acoma** are detailed in the legislation (see appendix A).<sup>2</sup> Under the legislation and

and patent under the mining laws, and granting of mineral and geothermal leases are prohibited.

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2. Acquisition of nonfederal property and interests in the monument will be based on recommendations in the **Land Protection Plan** (NPS 1989b).

Access to the monument and conservation area is ensured to Indian people for traditional cultural and religious purposes, including the harvesting of pine nuts, and such access is to be consistent with the American Indian Religious Freedom Act and the Wilderness Act. Planning will proceed in consultation with the Acoma and other Indian tribes to provide this access and protect traditional sites and values; the secretary may, on request, close areas temporarily to protect religious privacy.

Rights to the minimum amount of water necessary to carry out the purposes of the area are reserved to the federal government. Establishment of the monument does not affect preexisting water rights or applications pending (as of the date of the act) that are subsequently granted; the priority date of such rights is the date of enactment of the El Malpais Act. The Park Service is not required to allow future drilling of water wells within the boundaries of the monument.

Cooperation with other federal, state, and local public departments and agencies, Indian tribes, and nonprofit entities providing for the interpretation of prehistoric and historic civilizations in New Mexico and eastern Arizona is encouraged in order to provide unified and cost-effective interpretation. The secretary is also authorized to cooperate in the development and operation of a multiagency orientation center and programs on lands and interests in lands inside and outside of the boundaries of the monument and conservation area, with concurrence of the owner or administrator.

Funds are authorized for the national monument: \$1 million for development, \$10 million for land acquisition, and \$500,000 for planning and development of the Masau Trail.

In addition, the legislation sets forth requirements for the general management plans for both the monument and the conservation area. These plans will contain at least

visitor services plans, including “a continuing program of interpretation and public education about the resources and values of the monument”

proposals for public facilities, including a visitor center in the vicinity of Bandera Crater and a multiagency orientation center in or near Grants, New Mexico and adjacent to Interstate 40 to accommodate visitors to western New Mexico

natural and cultural resources management plans, “with a particular emphasis on the preservation and long-term scientific use of archeological resources. . . to be prepared in close consultation with the Advisory Council on Historic Preservation, the New Mexico State Historic Preservation Office, and the local Indian people and their traditional cultural and religious authorities”

wildlife resources management plans, prepared “in close consultation with appropriate departments of the State of New Mexico and using previous studies of the area”

a review and recommendation as to suitability or unsuitability for wilderness of all roadless lands within the boundaries of the monument, except the lands that are designated for development

## Natural Resource Issues

Natural resource studies have been conducted over the years by various agencies and individuals; however, many are dated. A full evaluation of monument resources has not yet been conducted, and additional information/studies are needed on

- threatened and endangered species
- lava tube systems and their fragile biota and rock and mineral formations
- ice deposits and the impacts of human use on these sensitive resources
- the impacts of grazing – including competition between livestock and wildlife for food and water, introduction of exotic vegetation, and degradation of soil, water quality, and aesthetics
- increasing backcountry use
- the incidence of wildfires, fuel-load buildups, and historical fire data
- threats to air quality (baseline data)

In addition, what impacts on soils, vegetation, wildlife, air quality, and visual quality will occur from construction and visitor use in and near developed areas? How will increasing visitation impact resources in backcountry areas, including areas identified as suitable for wilderness? What actions could be taken to mitigate these impacts?

There are scarred areas within the monument (related to past and present mining, timbering, and grazing operations). The main problems related to these practices are soil erosion, proliferation of exotic plant species, disturbance of wildlife habitat, and visual intrusions. Which of the disturbed areas need to be revegetated and how should reclamation be accomplished?

### **Cultural Resource Issues**

Without accurate information about the location, condition, and significance of cultural resources, visitor use or inappropriate siting of developments could damage the resources, resulting in the loss of scientific information and diminishing opportunities for interpretation. Also, without this information managers cannot make fully informed decisions and they cannot effectively monitor and preserve these resources. What programs need to be started and what are their priorities? What historic structures reports and other specialized plans are needed to guide research, adaptive use, and preservation maintenance actions? What sites are significant and should be nominated to the National Register of Historic Places?

What objects/specimens should be in the El Malpais museum collection? How and where will the collection be stored, managed, and protected? (There are currently no collection plans or curatorial storage facilities at the monument.)

What can be done to stop the looting and vandalism that seriously threaten the archeological resources? What staffing, educational programs, and other types of protection are necessary?

### **American Indian Concerns**

As specified in the enabling legislation, how will the mandated American Indian access to El Malpais for traditional uses, including religious and subsistence activities, be provided? How can visitor trespass on

Indian lands be prevented, and how can sacred sites be protected from curiosity seekers, looters, and vandals?

American Indians have expressed concerns that no religious objects be acquired or exhibited by the Park Service and that interpretive programs and media are respectful of American Indian cultures. In what ways can the National Park Service respond to these concerns and how can the Park Service provide interpretive media and information that is acceptable to the American Indians?

How can trust and improved communication between American Indians and federal agencies be promoted? What kind of programs would be acceptable, and what kind of consultation with American Indians would allay their concerns and ensure their input in proper management of monument resources?

### **Visitor Use Issues**

**On-Site Interpretation.** Some visitor assistance is available at the information center in Grants; however, except for a private tourist operation in the **Bandera Crater** area, on-site interpretation in the monument is almost totally absent. What access and facilities are needed so that visitors can enjoy a variety of natural and cultural resources? What messages and media (brochures, wayside exhibits, etc.) should the Park Service provide? Are there areas that may be environmentally unsafe for visitors who are not properly prepared, and if so what kind of warnings are appropriate?

**Cooperation.** The monument and conservation area are contiguous, and the lands of each are administered by two agencies; these lands are also important to various American Indian groups and are contiguous to their lands. What planning needs to take place between the two agencies to avoid duplication and inconsistencies in interpretive services and the selection of features to be interpreted? An interpretive program without consultation with American Indian groups would bypass one of the most important resources of the monument. How can the views of the Indians be incorporated into the interpretive program?

**Multiagency Center/Bandera Visitor Center.** The El Malpais legislation calls for proposals for a multiagency center near Grants and a visitor center

near **Bandera Crater**. What should be the specific functions, themes, and media concepts for each facility and how can duplication of information and efforts be avoided? How will information about the Masau Trail be presented at the multiagency center?

**Recreation.** What kind of recreational activities are compatible with protection of the resources and should be provided in the national monument?

## Access and Development Issues

**Roads.** Except for state highways 53 and 117 (hereafter referred to as NM 117 and NM 53), existing roads in the monument are inadequate to accommodate projected visitation and provide for public safety. Road maintenance, even on existing gravel segments, is expensive. County Route 42, like many of the little-used dirt roads, has irregular curves. Water collects on its sunken surface, leading drivers to circumnavigate impassable mud holes, resulting in environmental damage. Most road alignments within the monument do not consider aesthetics, including views of the landscape. The gravel road to Sandstone Bluffs overlook is the only significant visitor access on the east side of the monument. This road is dusty much of the year, becomes muddy after rain, and includes an unsafe curve.

To provide a safe and enjoyable visitor experience and adequately protect the monument resources, what roads need improvement or realignment? Is additional access to some parts of the monument needed? What should be done to provide all-season access to areas that are determined important for this kind of visitor use? Do any roads need to be closed?

**Facilities.** The temporary El Malpais information center in downtown Grants is the only public facility in the region for NPS and BLM information functions. Because of its small size and location, this facility cannot meet the visitor use needs of the monument once visitation begins to increase. The eastern side of the monument has no facilities for public use other than parking at Sandstone Bluffs overlook. The only developed facilities for day use on the western side of the monument are the privately owned trading post and trails at **Bandera Crater**, and these structures do not meet federal accessibility standards. What type and size of

facilities would accommodate projected visitation and interpretation, staff, and administrative functions?

**Utilities.** Utilities exist only at **Bandera Crater**, and these are inadequate to serve projected visitation. What electrical power and telephone services are needed for visitors and staff, and how can the lines be kept visually unobtrusive? What water and sewage treatment facilities are needed in the monument? How will adequate water be supplied?

**Trails.** There are few trails in the monument; trails in the **Bandera Crater** area do not lead to enough representative resources for monument purposes and do not provide for various levels of skill. What types of trails in what locations would provide appropriate visitor experiences? What improvements do existing trails need? How could the trail system developed for the monument incorporate the future Continental Divide Trail? The cost of developing new high-standard trails over lava compared to the likely volume of use is also an issue.

**Signs.** Signs for orientation and information within the monument are virtually nonexistent. The few existing government signs merely mark the monument and conservation area boundaries on NM 53 and NM 117; most of the monument is also lacking signs that identify access and important regulations. What signs are needed and where? What sign design would be easily comprehended and compatible with the resources and landscape? What coordination can be done between the Park Service and the Bureau of Land Management to ensure harmonious and nonduplicative signs?

**Handicap Access.** Currently there are no special facilities or trail improvements anywhere in the monument to accommodate visitors with mobility, mental, or sensory handicaps. Except for the little that can be seen from inside an automobile, there are no opportunities for handicapped visitors to have firsthand observations of lava caves, lava surface features, or cultural resources. What can be done to make representative areas of the monument available to handicapped individuals?

## Management and Operations Issues

The current level of staffing does not adequately provide for management of the monument and its

resources in a way that protects the environment and complies with legislative requirements. What programs and staffing levels are needed to provide basic visitor services, maintenance activities, and protection, monitoring, and research of the monument's natural and cultural resources?

There is a total absence of offices, maintenance space, and housing for personnel within the monument boundary. Where should offices and housing be located so that personnel can provide effective management of visitor services and resources, respond to emergency situations, and dissuade illegal behavior such as looting, vandalism, and trespass? Where should fire suppression equipment, first-aid supplies, and other materials required for emergencies be stored?

Should the administrative headquarters continue to be in a central location, with nearby commercial and housing opportunities? Is the current administrative space large enough to accommodate increases in the monument staff as visitation grows?

### **Socioeconomic Issues**

New jobs and an increase in tourism because of development at El Malpais would help improve the local economy. How can the national monument best contribute to the local economy without compromising the values for which the monument was established?

### **Issues of Coordination with Other Agencies**

What agencies and other entities should join in planning the multiagency center, and what geographic areas and informational services should be within the scope of the facility?

Along NM 117 there are several features of great importance to El Malpais' natural landscape and the archeological and ethnographic resources (some on BLM-managed land and some on NPS-managed land). The Park Service and the Bureau of Land Management have a mutual interest in developing facilities and programs that offer long-term, integral protection of the resources along NM 117 and in meeting the needs of visitors along the NM 117 corridor. What type of facilities will be required to effectively manage the corridor, where should they be built, and what staffing from

both agencies is required? How will the Bureau of Land Management and the Park Service plan access to and interpretation of these features so that their activities are complementary but not duplicative? What areas should be interpreted and made accessible by viewpoints and trails? What personal services versus self-guided services should be made available to provide visitors a safe and interesting experience for visitors?

What common programs of protecting archeological and ethnographic sites are needed? What mutual coordination with local American Indians is required to meet the requirements of Public Law 100-225 and other laws and regulations?

Although these issues relate most directly to the NM 117 corridor, the problems of how to provide common programs for protecting archeological and ethnographic sites and natural resources are also issues for the entire national conservation area and national monument.

### **RELATIONSHIP TO THE LAND PROTECTION PLAN**

The National Park Service has been charged by Congress with preservation and protection of park resources and with providing for use of park system areas by the visiting public. To this end, land protection plans are prepared to:

Determine what land or interests in land need to be in public ownership, and what means of protection other than acquisition are available to achieve unit purposes as established by Congress.

Inform landowners about NPS intentions for buying or protecting land through other means within the unit.

Help managers identify priorities for making budget requests and allocating available funds to protect land and unit resources.

Find opportunities to help protect the unit by cooperating with state or local governments, landowners, and the private sector.

The Land Protection *Plan* (NPS 1989b) for El Malpais National Monument has been prepared by the NPS Southwest Regional Office separately but

in coordination with this general management plan. Once approved, the Land Protection *Plan* will become an action element of this general management plan. The Land Protection *Plan* was reviewed by the public in May and June, 1989, with public open houses held June 1 and 2.

The El Malpais *Land Protection Plan* serves as a guide for what land or interests in land need to be in federal ownership, what means of protection are available to achieve the purpose of the monument as established by Congress, and what priorities for acquisition are appropriate. Approximately 18,479 acres of land within the authorized boundary of the monument (16 percent of the total monument) is currently not in federal ownership (it is in private, state, and county ownerships). The *Land Protection Plan* proposes that all of this land be acquired by the Park Service in fee. The rationale for this proposal is fourfold.

The natural resources of the monument are nationally significant and most are nonrenewable. Many resources are very fragile and require high levels of management and protection.

The extensive cultural resources found in the monument are also fragile and nonrenewable. They constitute an important and scientifically significant data base, and their integrity must be preserved. This can best be accomplished through fee acquisition.

Much of the monument land is sacred to the American Indians and is important in their traditions. Federal ownership must ensure access to the land for American Indian religious and traditional purposes over the long term. This access will not be guaranteed if the land remains in private ownership.

There are relatively few areas suitable for administrative and visitor facilities because of the fragility of some volcanic features, the abundance of sacred and archeological sites, the religious importance attached to the land itself, and the rough, volcanic terrain. Most of the suitable areas are now in private ownership.

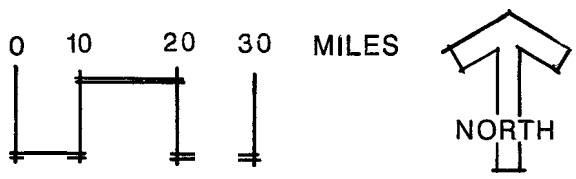
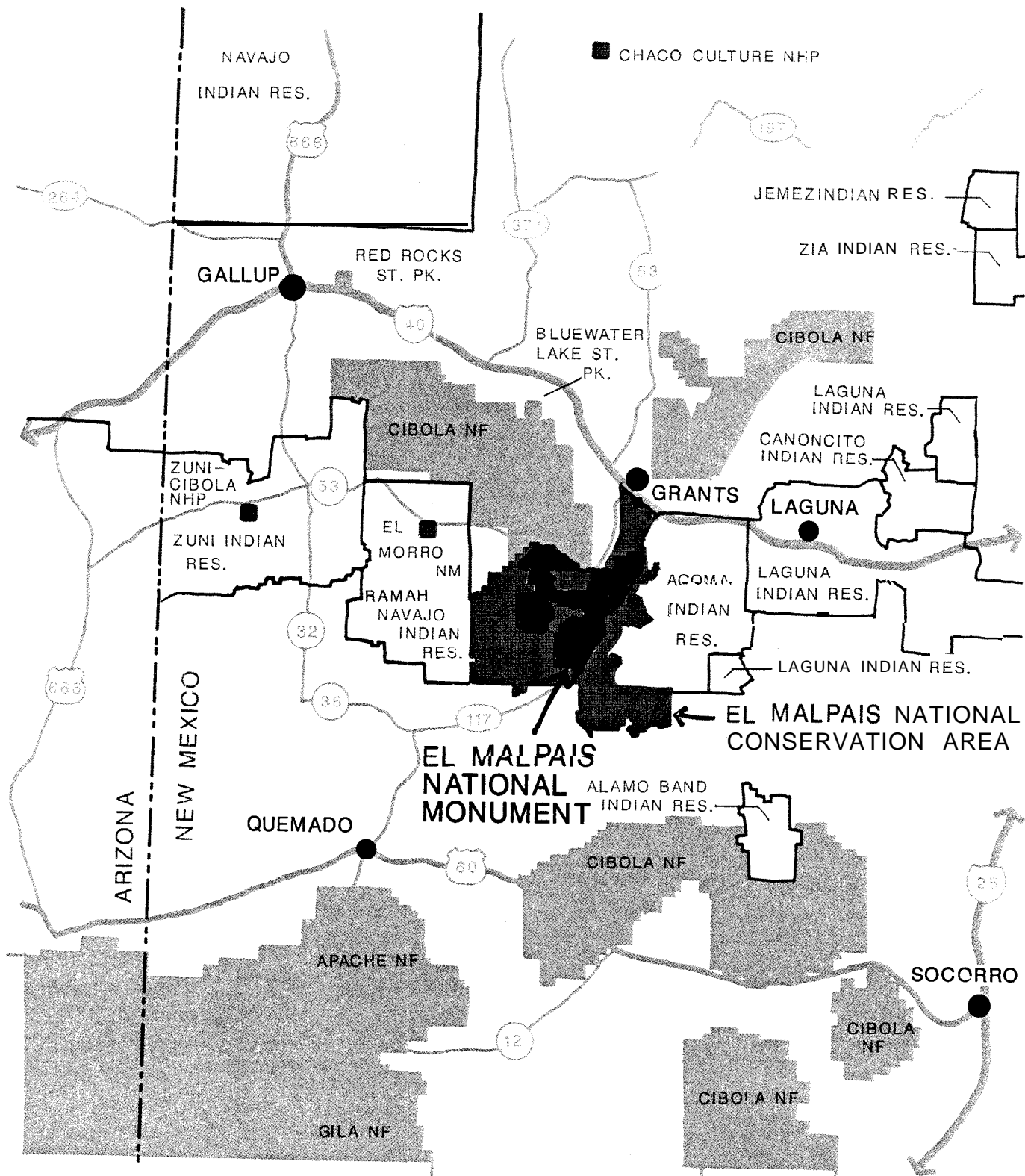
The *Land Protection Plan* identifies a number of issues that can affect the integrity of the monument's resources and the quality of the visitor

experience. These issues include: incompatible uses that are occurring on nonfederal lands within the monument; protecting resources that are integral to the monument (some of which are currently on privately owned land); providing for optimal placement of visitor and management facilities; boundary adjustments; protecting potential wilderness areas for visitor enjoyment and proper land management; and conditions outside of the monument boundaries that can adversely affect monument lands or the visitor experience. These issues and solutions are discussed in detail in the *Land Protection Plan*.

## BRIEF DESCRIPTION OF THE MONUMENT

As the Vicinity and Existing Conditions maps show, El Malpais National Monument/National Conservation Area is in northwestern New Mexico. Grants, New Mexico, on Interstate 40 (I-40), is at the northern edge of the monument. The 114,992-acre monument, entirely within Cibola County, is bounded on the east by NM 117 and on the northwest by NM 53. Most of the national monument is surrounded by El Malpais National Conservation Area. The monument is mostly volcanic terrain and includes some of the most recent lava flows in the continental United States. There are numerous archeological sites and other cultural resources, unusual biological resources, and many ice caves, lava tubes, kipukas, spattercones, lava tree casts, and other interesting volcanic features in the monument. The Existing Conditions map shows some of the placenames and areas discussed throughout the document.

At El Malpais, lava tubes, ice caves, and unusual plant associations, and human culture, history, and prehistory all merge in a rich mosaic. The McCarty flow and other lands are a vast cultural landscape, with traditional importance to several American Indian peoples -the Acoma, Laguna, Ramah Navajo, and Zuni Indian tribes. El Malpais is much more than an economic, scientific, and recreational resource, as recognized in the special provisions of the legislation that authorized the national monument and conservation area.

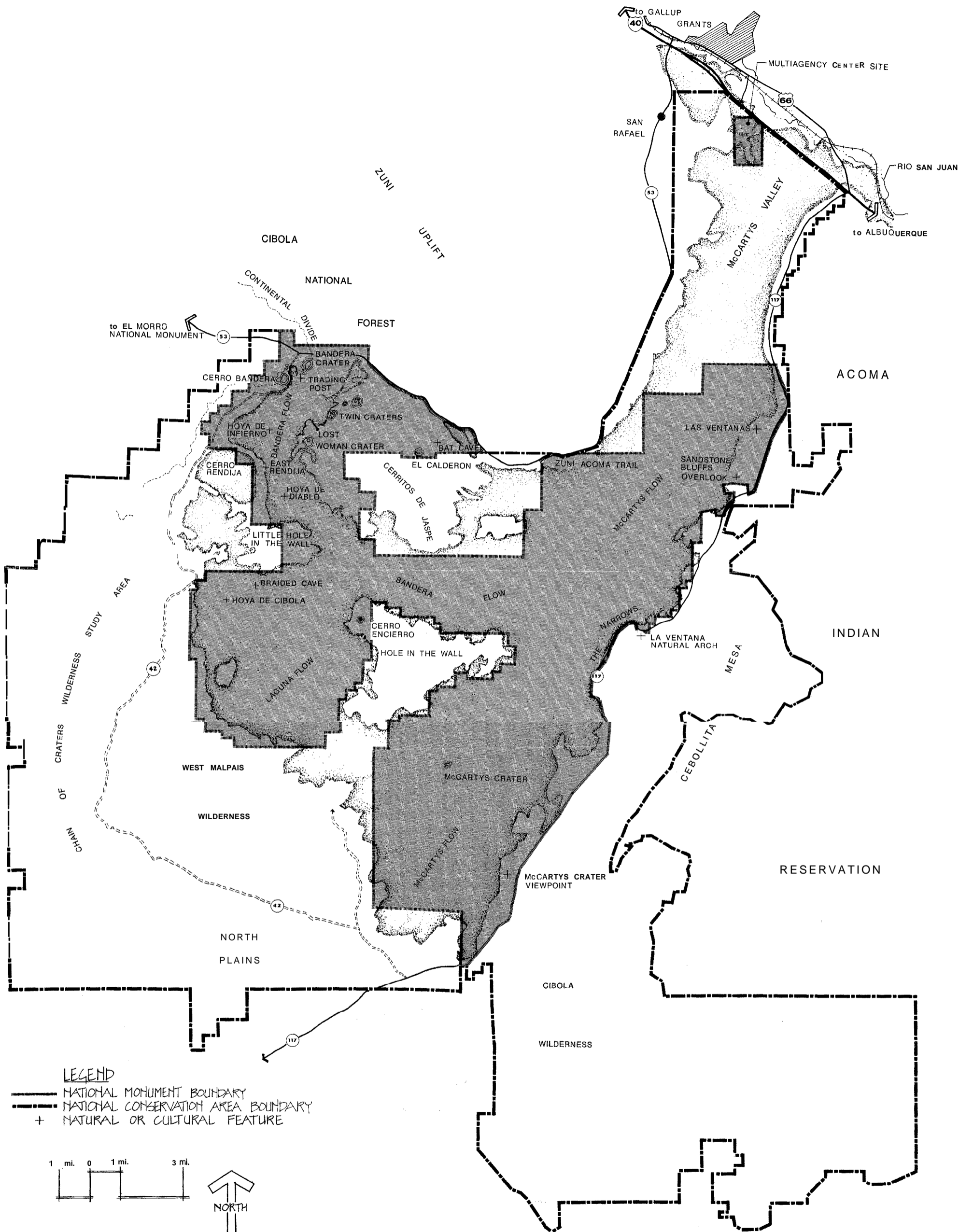


**VICINITY**

**EL MALPAIS NATIONAL MONUMENT**  
**U.S. DEPARTMENT OF THE INTERIOR**  
**NATIONAL PARK SERVICE**

# THE PROPOSED PLAN AND ALTERNATIVES





## EXISTING CONDITIONS

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,005

## BANDERA CRATER VISITOR CENTER

- BUILD NEW HANDICAP-ACCESSIBLE VISITOR CENTER WITH TWO-WAY PAVED ACCESS FROM NM 53; PAVED PARKING
- CONSTRUCT PAVED ONE-WAY TOUR ROAD FROM VISITOR CENTER TO TRADING POST PARKING AREA; CONTINUE ROAD TO NM 53
- CONSTRUCT PAVED ACCESS; PARKING TO ¼ MILE FROM DRIPPING LAVA CAVE; DEVELOP TRAILHEAD; TRAILS TO DRIPPING LAVA CAVE (PROVIDE STAIR ACCESS); LAVA CRATER
- DEVELOP INTERCONNECTING TRAIL SYSTEM TO LAVA FLOW MARCH, SANDSTONE RIDGE, TRADING POST; SPATTERCONE VALLEY. DEVELOP UTILITY SYSTEM FOR VISITOR CENTER, MAINT./RES. AREAS; TRADING POST

## NPS RESIDENCE; MAINTENANCE AREAS

- CONSTRUCT PAVED ACCESS FROM NM 53; PAVED PARKING
- BUILD 4 RESIDENCES; ONE 4-UNIT APARTMENT BUILDING
- BUILD 4-BAY MAINTENANCE BUILDING

## EL CALDERON AREA

- GRAVEL EXISTING ROAD TO JUNCTION CAVE; CONSTRUCT NEW GRAVEL ROAD TO NEW PARKING AREA ¼ MILE FROM BAT CAVE; PROVIDE VAULT TOILETS
- DEVELOP TRAILS TO BAT CAVE; DOUBLE SINKS FROM PARKING AREA; CLOSE EAST SIDE OF BAT CAVE; ALLOW VIEWING
- CLOSE CORRAL ROAD AFTER IMPROVEMENTS MADE ON EL CALDERON ROAD; MARK JUNCTION CAVE TRAIL AND EXTEND TO DOUBLE SINKS; PARKING

## ZUNI-ACOMA TRAIL

- USE; REDESIGN EXISTING PARKING
- MAKE TRAIL TO VIEWPOINT WHEELCHAIR-ACCESSIBLE

## MULTIAGENCY VISITOR CENTER

- CONSTRUCT PAVED ACCESS FROM EAST I-40 INTERCHANGE
- CONSTRUCT HANDICAP-ACCESSIBLE ORIENTATION/INFORMATION CENTER; PAVED PARKING
- DEVELOP SHORT TRAIL

## TRADING POST

- REHABILITATE CONTRIBUTING HISTORIC STRUCTURES FOR ADAPTIVE USE; REMOVE NONCONTRIBUTING STRUCTURES; REDESIGN PARKING
- DEVELOP TRAILS TO SPATTERCONE VALLEY; CERRO BANDERA TRAILHEAD
- PROVIDE PICNIC TABLES (AT LEAST ONE SITE WHEELCHAIR-ACCESSIBLE) NEAR TRADING POST
- MAKE TRAIL TO ICE CAVE; LAVA SURFACE FEATURES WHEELCHAIR-ACCESSIBLE; PROVIDE STAIRS; PLATFORM AT ICE CAVE

## ROUTE 42

- REALIGN FIRST 2 MILES FROM NM 53;
- GRAVEL; ELEVATE ROAD FROM NM 53 TO EAST RENDIJA TRAILHEAD
- CLOSE; REVEGETATE FIRST 2 MILES OF EXISTING ALIGNMENT
- DEVELOP SPUR ROAD, PARKING, TRAILHEAD TRAIL TO SUMMIT OF CERRO BANDERA

## EAST RENDIJA AREA

- PROVIDE 6-SITE PRIMITIVE CAMPGROUND WITH VAULT TOILETS
- FORMALIZE; GRAVEL PARKING; PROVIDE VAULT TOILETS FOR CAVE AREA TRAILHEAD
- DEVELOP TRAILS TO BIG SKYLIGHT; FOUR WINDOWS CAVES
- MARK ROUTES TO SEVEN BRIDGES; CATERPILLAR CELLARIES
- CONSTRUCT GRAVEL ROADSIDE PARKING; LOOP TRAIL NEAR THE LAVA WALL

## BRAIDED CAVE

- GATE EXISTING; ACCESS ROAD; PROVIDE UNIMPROVED DIRT PARKING AREA NEARBY
- MARK ROUTE TO BRAIDED CAVE

## LAS VENTANAS

- CONSTRUCT PAVED SPUR ROAD OFF SANDSTONE BLUFFS ROAD
- DEVELOP TRAILHEAD; TRAIL TO NATURAL ARCH, VIEWPOINTS, ROOM BLOCK, TOWER; GREAT KIVAS
- OPTIONALLY, REMOVE BACKFILL; STABILIZE TOWER KIVA

## RANGER STATION (BLM)

- BUILD STATION, PAVED ACCESS, PARKING, RESIDENCE
- DEVELOP INTERPRETIVE TRAIL

## SANDSTONE BLUFFS

- REALIGN; PAVE EXISTING ROAD
- REDESIGN; PAVE EXISTING PARKING
- PROVIDE WHEELCHAIR-ACCESSIBLE VAULT TOILETS; TRAIL TO OVERLOOK
- INSTALL LOCKABLE GATE FOR OVERNIGHT CLOSURE NEAR NM 117

## ACOMA-ZUNI TRAIL

- CONSTRUCT PAVED ROADSIDE PARKING; TRAIL HEAD (IF EASEMENT ACQUIRED)

## LA VENTANA (BLM)

- CONSTRUCT GRAVEL PARKING AREA; DEVELOP TRAILHEAD; LOOP TRAIL TO ARCH (WHEELCHAIR-ACCESSIBLE SPUR TO VIEWPOINT)
- PROVIDE VAULT TOILETS

## THE NARROWS

- CONSTRUCT PAVED ROADSIDE PARKING
- DEVELOP WHEELCHAIR-ACCESSIBLE TRAIL TO LAVA SURFACE FEATURES
- MARK ADDITIONAL TRAIL TO OTHER FEATURES

## SOUTH BIG NARROWS (BLM)

- REDESIGN; GRAVEL ACCESS; PARKING
- PROVIDE PICNIC AREA
- DEVELOP TRAILHEAD FOR CEBOLLA WILDERNESS

## MCCARTY'S VIEWPOINT

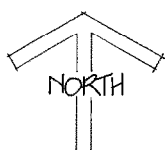
- CONSTRUCT ¼-MI. PAVED SPUR ROAD AND PARKING; DEVELOP TRAILHEAD; TRAIL TO VIEWPOINT; ADD ORIENTATION WAYSIDE (OPTION 1)
- NO DEVELOPMENT (OPTION 2)

## NM 117 ROADSIDE KIOSK (SOUTH)

- IF OPTION 2 SELECTED FOR MCCARTY'S VIEWPOINT:
- DEVELOP PAVED ROADSIDE PARKING
- CONSTRUCT ORIENTATION/INFORMATION KIOSK

## LEGEND

- NATIONAL MONUMENT BOUNDARY (NPS)
- NATIONAL CONSERVATION AREA BOUNDARY (BLM)

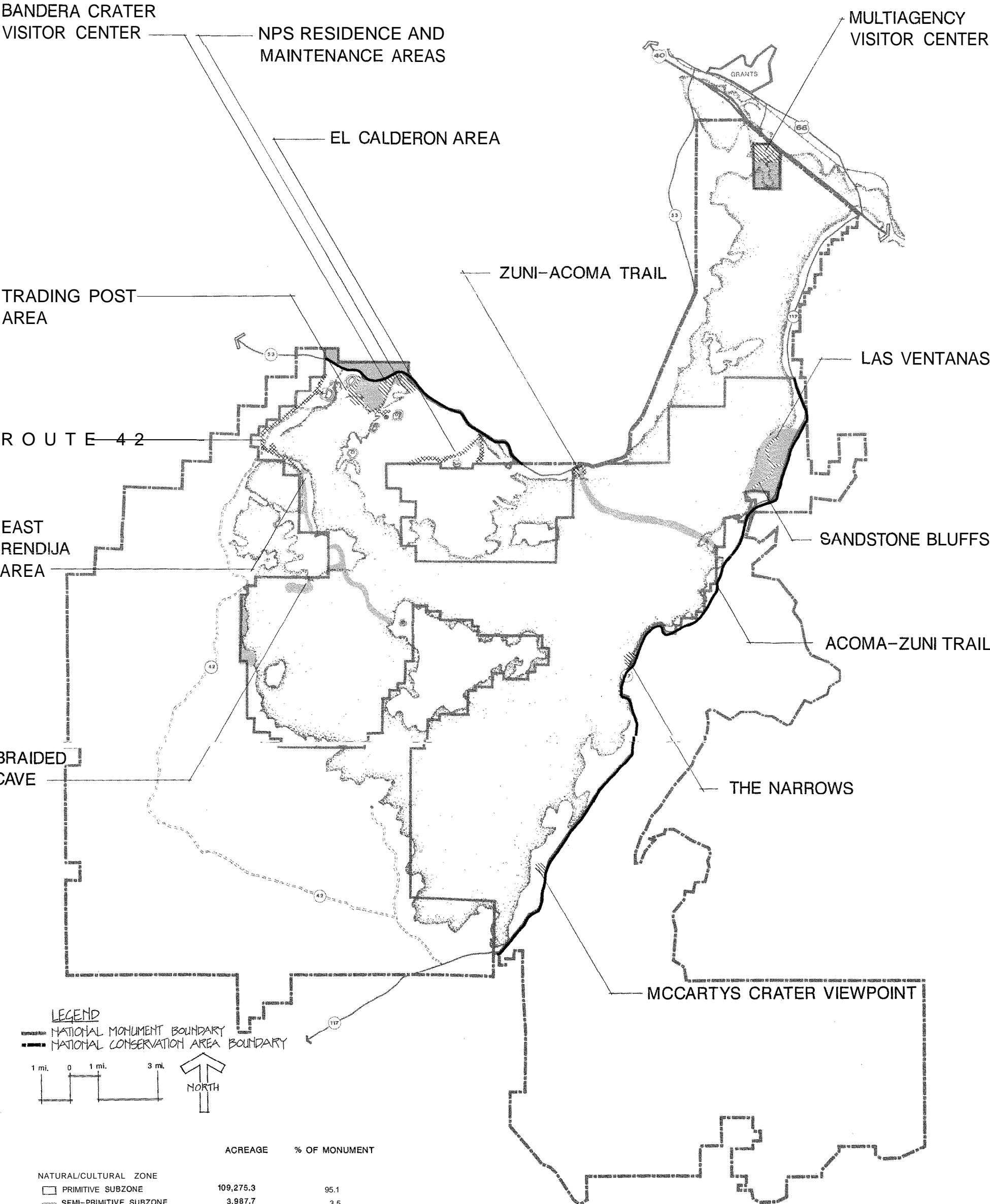


## GENERAL DEVELOPMENT PREFERRED ALTERNATIVE

EL MALPAIS NATIONAL MONUMENT

U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/DEC 1988/10/3/20,007A



	ACREAGE	% OF MONUMENT
NATURAL/CULTURAL ZONE		
PRIMITIVE SUBZONE	109,275.3	95.1
SEMI-PRIMITIVE SUBZONE	3,987.7	3.5
MONUMENT DEVELOPMENT ZONE		
RUSTIC SUBZONE	455.2	0.4
DEVELOPED SUBZONE	804.7	0.7
SPECIAL USE ZONE		
TRANSPORTATION SUBZONE	399.4	0.3
TOTAL	114,922.3	100.0

**MANAGEMENT ZONING**  
EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE  
DSC/JULY 1989/103/20,009

\* ALL LAND IS DEPICTED IN THE SUBZONE WHERE IT WOULD BE CLASSIFIED IF ACQUIRED BY THE NPS  
FOR THE LOCATION OF PRIVATE LANDS, REFER TO THE LAND PROTECTION PLAN.

## INTRODUCTION

### THE ALTERNATIVES

This draft NPS general management plan contains two alternatives -the Park Service's preferred alternative and the minimum requirements alternative.

The preferred alternative meets the statutory proposals for visitor centers at Grants and Bandera Crater and recommends additional development, including facilities necessary for visitors to see representative monument resources without infringing on American Indian interests. The preferred alternative provides the necessary initial protection of the cultural and natural resources for this new unit of the national park system. The minimum requirements alternative contains the lowest feasible scale of action to make the monument operational and provide for minimal visitor use and resource protection (see later description for details).

Details important to an understanding of the monument's resources are presented in the "Affected Environment" section, and an evaluation of the impacts of each of the two alternatives is presented in the "Environmental Consequences" section of this document.

It should be noted that the two alternatives presented here are different than the alternatives presented in the *El Malpais Update* (public newsletter) issued in December 1988. The four alternatives in the *Update* were meant to elicit public opinion about the results of planning at an earlier stage when the options for visitor use and development were broader and not directed toward the most feasible solutions, which is the objective of this draft general management plan. With input from the public from the questionnaire in the *Update* and public meetings, and with detailed attention by the members of the planning team and many consultants to all relevant issues and legal and policy requirements, the preferred alternative contained in this document is presented for

additional public review. A summary of public involvement is in appendix B.

The planning process followed by the Park Service often includes a "no-action" alternative. However, a no-action alternative was not considered viable for this general management plan because the Park Service is required in the El Malpais legislation to include specific proposals for development of a multiagency center in the Grants area and a visitor center in the Bandera Crater area. Thus any alternative would include this action – i.e., proposals that these centers be developed. In effect, the minimum requirements alternative serves as the no-action alternative in this document.

### COOPERATIVE PLANNING

A key aspect of planning for El Malpais has involved cooperative planning - with the Bureau of Land Management, with American Indian groups, and with other interested organizations (the city of Grants, the Grants Chamber of Commerce, the Cibola Convention and Visitors Bureau, etc.). This summary of cooperative planning is presented to show how common issues have been resolved during the planning process.

During planning, NPS and BLM teams met several times and reviewed the significance of the national monument and the national conservation area. A list of interpretive objectives that would guide preparation of the alternatives for visitor use (access and interpretation) was compiled by the two teams.<sup>3</sup> After formulating the alternatives for both areas, the teams met again to ensure that these alternatives would not be in conflict and would serve the overall visitor experiences of the national monument and the national conservation area.

Cooperative planning for the multiagency center at Grants involved group workshops, which aimed at defining the objectives of that proposed facility. The planning included the NPS and BLM teams and

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3. These objectives can be found in the introduction to the "Visitor Services/Interpretation Plan" section of this document.

also representatives of the Forest Service, the New Mexico Departments of Tourism and Natural Resources, the city of Grants, Grants Chamber of Commerce, the Cibola Convention and Visitor Bureau, and the Pueblo of Acoma. Important guidance as to the geographic scope and the character of informational services and media resulted from these workshops.

Visitor use alternatives for the NM 117 corridor were of particular concern because of the important features in this area, the mutual **NPS/BLM** boundary along most of the corridor, and the concern of the American Indians about sites of religious significance and other uses of adjacent tribal lands. NPS and BLM planners agreed not to duplicate trail access onto the lava areas of Big South Narrows. They also agreed that different aspects of the prehistoric story warranted public access to both Las Ventanas in the national monument and the Dittert site in the national conservation area. The two teams recommended bi-agency information kiosks at both ends of the NM 117 corridor. The Park Service provided assistance in trail planning at La Ventana arch.

NPS design and engineering specialists consulted with the BLM planning team and reviewed their site alternatives for a ranger station in the NM 117 corridor. Potential water supply and limitations imposed by soils, floodplains, and highway access entered into the evaluation. The BLM planning process led to selection of a site east of NM 117, about 9 miles south of Interstate 40. This station would be built and staffed by BLM personnel and contain space for a resident ranger who would patrol and respond to emergencies in this part of El Malpais. By cooperative agreement, this facility could also distribute information on the national monument and assist the Park Service in monitoring use in adjacent parts of the national monument, including the Sandstone Bluffs and Las Ventanas area where archeological and ethnographic resources need to be protected.

Planners of both agencies consulted with authorities from concerned Indian tribes about areas that should be avoided because of their religious significance.

The results of these joint planning efforts for visitor use can be seen on the General Development map, which shows the distribution of visitor support developments of the two agencies along NM 117

(BLM proposals are in lighter type face). The text following the map details access and visitor use at the NPS areas and summarizes BLM proposals. Details of BLM proposals can be found in the BLM's draft general management plan.

Early in the planning, the Bureau of Land Management transferred their existing resource data on the national monument to the Park Service. The Bureau of Land Management also developed a geographic information system for the national monument and the national conservation area, including elevation, topography, slope, aspect, drainage, soil, and vegetation. This has led to identification of the biophysical land units shared by both the national monument and the national conservation area, and in the future the two agencies will be able to formulate interrelated resource plans that address fire management, models for archeological research and protection, and other topics.

During planning, the Park Service and the Bureau of Land Management divided some tasks of cultural resource evaluation. Historic themes and resources were compiled by consultants to the NPS team, and the ethnographic overview – leading to a comprehensive synthesis of existing data – was undertaken under contract by the Bureau of Land Management. (Future ethnographic studies will include the detailed information required by NPS policy and will cover both the national monument and the national conservation area.)

# THE PREFERRED ALTERNATIVE

## INTRODUCTION

Because El Malpais is a new national monument and has very little infrastructure for supporting visitor services and management, it is important that the preferred alternative effectively addresses the development needs while ensuring a high level of protection for the resources, including those important to American Indians. A summary of the preferred alternative is presented on the General Development – Preferred Alternative map.

The natural and cultural resources management plan sections, described later as part of the preferred alternative, are integral parts of the alternative, as is the wilderness suitability study.

The preferred alternative will take about 15 years to implement, and the various steps needed for implementation have been prioritized. Comprehensive design for facilities and surveys for archeological, ethnographic, and natural resources will be completed before any actions are undertaken; depending on survey results, details of the general management plan will be modified, as necessary, to mitigate adverse effects on these resources.

## MANAGEMENT ZONING

### The Zones

For NPS management purposes El Malpais National Monument is divided into three zones: natural/cultural, monument development, and special use (see Management Zoning map). These zones have been further divided into a number of subzones. This land classification framework provides essential guidance for monument development and administration and ensures a broad range of recreational experiences.

The **natural/cultural zone** will be managed to conserve the natural resources and processes of the monument, and to preserve, protect, and interpret its cultural resources (prehistoric and historic). Ethnographic resources, including sites of religious and subsistence importance to American Indians, will be protected. As per legal

requirements, American Indian access to these sites and privacy for their religious observances will be ensured. Public uses that are allowed within this zone will be those that do not adversely affect the resources and natural processes. The natural/cultural zone is further divided into the **primitive** and **semi-primitive subzones** (described in detail in appendix C).

Traditionally, natural and cultural resources are identified separately in management zoning frameworks. However, these two types of resources have been combined into one category at El Malpais because of

the close relationship between the natural environment and cultural sites,

the entire natural landscape being part of the cultural landscape,

the special religious importance of many of the culturally significant sites within the monument to one or more of the local American Indian groups (the identification of these sites in a specific zone could attract inappropriate uses that might compromise the integrity or sanctity of the sites), and

the knowledge of the location and extent of the numerous natural and cultural resources in the monument is so incomplete that their separate identification is not practicable at this time.

The **monument development zone** will be managed to provide and maintain the facilities necessary to serve the needs of visitors and management. This zone includes areas where certain development and/or use may alter the natural environment or the setting of culturally significant resources. To the extent possible, this **subzone** will maintain the natural and cultural character of El Malpais while accommodating visitor use and monument management activities. Any national register sites in this zone will be managed in consideration of the provisions of their designation. Development and use will be controlled in a manner that will provide visitors with a quality recreational experience. The monument

development zone is further divided into the **rustic** and **developed subzones** (described in detail in appendix C).

The **special use zone** includes the activities carried out on private lands within the monument boundaries. NPS administrative control over use of lands in this zone is either absent or is secondary to that of other parties. The special use zone is limited to a **transportation subzone** that includes the state highways and attendant rights-of-way.

The management zoning framework, including subzones, is graphically depicted on the Management Zoning map. Although this map shows the zoning for the entire monument, the proposed zoning will have no effect on nonfederal lands unless and until the Park Service actually acquires those lands or interests. However, the zones as shown indicate the management emphasis that would be placed on these nonfederal areas should they be acquired. It must be stressed that the integration of private property into management zones does not imply permission for public use of that property. Public use of these tracts will not be permitted until the lands are acquired by the federal government. Further, the regulatory stipulations of each zone or subzone do not limit the rights of private property owners.

Finally, it is important to recognize that any or all zones (including subzones) may contain resources that are either unidentified or whose significance is not yet fully determined. The management strategy in regard to the lands in federal ownership is to identify these resources through surveys, determine their significance, and prescribe their protection and treatment for preservation. Eligible cultural resources on federally owned lands will be nominated for listing on the National Register of Historic Places. Similarly, significant natural resources may qualify as units of the National Natural Landmarks program or be set aside as research natural areas and receive special management protection. The superintendent may declare special zoning designations in areas that are found to contain especially significant and/or fragile resources or that are needed for research purposes. Any special zoning designation that may be established will be managed under conditions specified by the superintendent.

## The Visitor Experience in the Management Zones

This section briefly describes the predicted type of experience visitors will have in the four subzones of the natural/cultural and monument development zones of El Malpais National Monument. Additional information on the frequency of encounter with other people, the character of interpretive media, and the standards of roads and trails are in the section of this document on recreational activities and in appendixes C and D.

In the **primitive subzone**, which has no roads and few marked routes, visitors will feel self-reliant and like they are exploring. They will find interesting features and at times commune with the beauty and harshness of their surroundings. Some visitors will orienteer to selected destinations, such as remote lava caves, but even then they will have a sense of original discovery as they explore in solitude.

In the **semi-primitive subzone**, with its relatively difficult access on rough roads and on simple marked routes, visitors will travel to features such as lava caves and collapses and feel immersed in an undisturbed land. They will have few reminders of the civilized world and will be largely reliant on their own observations to attach meaning to the natural and cultural landscape.

In the **rustic subzone**, with its gravel roads and well-defined trails, visitors will travel to interesting natural and cultural features and they can camp if they chose. They will have opportunities to learn about their surroundings through on-site interpretive media such as exhibits and pamphlets; however, they will also enjoy interesting natural features at their own pace.

In the **developed subzone**, with its visitor centers, paved and one-way tour roads, and gentle trails shared with numerous people, visitors will feel directed along a predetermined sequence of stops. There will usually be many other tourists around, some of whom will have limited time and are only seeing certain highlighted resources. Many of the monument's most significant and spectacular features are deliberately included in this **subzone** to give visitors with limited time or ability chances to see some significant and representative features of the monument.

## Jurisdiction

It is NPS policy to obtain concurrent jurisdiction within units of the national park system. The Park Service currently has only proprietary jurisdiction in El Malpais National Monument. Within the monument, concurrent jurisdiction will be sought for all areas except the NM 53 and NM 117 rights-of-way, which would remain in proprietary jurisdiction.

## VISITOR FACILITIES/DEVELOPMENT PLAN

The monument headquarters, visitor centers, operational facilities, roads, trails, viewpoints, and campgrounds are described in this section on visitor facilities. Proposed facilities will be designed for minimal damage to resources and to harmonize with the surrounding environment. Structures will be the minimal size necessary to accomplish their function, and trails and viewing platforms will be properly designed and constructed to discourage off-trail use. Nonreflective materials and natural colors will be used where possible, and signs will be the minimum necessary to guide and educate the visitor. Proposed facilities will also be designed for low-consumptive water use. (See appendix D for a description of the trail standards that are shown on the maps in this section and appendix E for a discussion of design guidelines for these facilities.)

Disturbed areas will be revegetated, restoring the natural resource values and visual integrity of these sites. This **revegetation/reclamation** would be carefully balanced with natural recovery (i.e., these areas would blend with the existing landscape, maintain genetic integrity, and prevent introduction/spread of exotic species). Only plant materials native to the site will be used for revegetation. Topsoil will be removed and stockpiled for use during reclamation. Mulch matting, silt fences, hydromulching, check dams, and other erosion reduction techniques will be used. Appropriate measures will be taken to protect cultural resources during the revegetation process.

Prior to construction, development sites will be surveyed and evaluated for federal and state threatened or endangered plant and animal species. An archeological survey will be undertaken prior to development. Facility development and increased visitor use will also be monitored over the life of the plan, providing the Park Service and other

federal agencies with updated information on local, federal, and state protected species.

It should be noted that all areas of the monument are currently accessible 24 hours a day. The preferred alternative considers that some of these areas will be closed during the night with lockable gates to protect monument facilities and resources or ensure visitor safety.

Following are site-specific development plans for the preferred alternative.

### Administrative Headquarters

Although currently in the former Forest Service building in Grants, the monument's headquarters will ultimately be moved to a place that will accommodate the staff as it grows to the proposed level (which is described in a later section on staffing). This location will be leased, located in Grants, and will meet the criteria for space and other NPS requirements. Grants is a central location and is the most effective site for the headquarters. There is currently an ample supply of reasonably priced rental space available in Grants. Placing primary administrative functions in the multiagency center or at the **Bandera** visitor center is undesirable because of the likely conflict of two functions in one building and because of the potential of administrative functions to impinge on visitor functions. Combining administrative and visitor functions in one building would also likely compound costs of new construction. (A larger visitor center would also increase impacts on the natural and visual environment.) Also, being in Grants, the monument staff will have convenient access to local, state, federal, and tribal officials with whom the staff must work on a regular basis.

### Multiagency Center, Grants

As shown on the following Multiagency Center DCP (development concept plan) map, under the preferred alternative the multiagency center in Grants will be convenient to a paved access road from the I-40 interchange at the east end of the city of Grants in a detached portion of the national monument. Approximately 481 acres of land will be acquired in fee, beginning from the southern I-40 right-of-way south to a common boundary with the conservation area. (As described in the section on

boundary proposals, the size and configuration of the existing 1,089-acre tract originally set aside for this purpose will be administratively adjusted. This adjustment is shown on the Boundary Proposal map in a later section of this document.) Effective signs will be provided on I-40. The purposes of the multiagency center are described in the "Visitor Services/Interpretation Plan" section.

Although adjacent to a busy interstate and a proposed industrial park (including a National Guard building), the multiagency center site will be distinguishable from adjacent uses, reflect a design that is indigenous to the region, and have an aesthetic appearance consistent with NPS design standards. The entrance will be easily identifiable. A distinctive name for the facility will be important (perhaps "Land of the Ancients"). The building will use passive solar energy, and external utilities will connect with existing lines from Grants.

Careful site selection will result in an optimal location for the facility. Designers will work with the Greater Grants Industrial Development Foundation to mitigate adverse effects of the industrial park that is planned, part of which is within existing monument boundaries near the visitor center site. (See "Proposed Monument Boundary Adjustment" section for further discussion of this situation.)

The approach road and landscaping for the building will adhere to the principles of quality design (as described in appendix E) and also ensure that the facility has ample surrounding space to maintain its visual integrity. Landscaping for the grounds and entrance road will be a blend of native trees, shrubs, grasses, and groundcovers. The parking area for the visitor center will have native deciduous shade trees, and because the parcel is relatively level the parking area will be screened from the I-40 interchange where feasible.

The main view from the visitor center will be the unobstructed southern panorama of both the monument and the conservation area. Because this view is important for orienting the visitor to the monument's geography, design will be conducted with special care.

The center will be fully handicap accessible and contain almost 7,000 square feet. A detailed discussion of the size and functions of the proposed visitor center is included in appendix F. The center will include the following:

an information/reception area, with information desk, orientation exhibits to features and activities in the area, and identification of the different agencies involved in the center

a publication display and sales area

a travel planning area where visitors can refer to information and maps to refine travel plans

an exhibit area with audiovisual (AV) units, in alcoves and/or as parts of exhibits

an AV theater

a plaza adjoining the building, which has shaded seating for summertime visitors to escape the sun, serves as a waiting area for family or group members, is a starting point for a short loop trail (with interpretation of features that can be seen from the trail), and which can be used for occasional talks and/or demonstrations by American Indian craftspeople

office/working space for employees of the facility

public restrooms

In addition to the National Park Service, agencies that have expressed at least a tentative interest in being represented in the building include the Bureau of Land Management, the U.S. Forest Service, the Pueblo of Acoma, the Ramah Navajo Chapter, the Grants Chamber of Commerce, and the New Mexico Division of Tourism.

All media for the center will be planned and designed by the NPS Harpers Ferry Center to ensure continuity of design. The other agencies and interested American Indian groups will be consulted relative to the resources and interpretive messages affecting their areas during this process.

The Park Service will design and construct the multiagency center. Agreements with other agencies will be negotiated relative to staffing and sharing the operational costs.

## Bandera Crater Area

The Bandera visitor center will be the primary interpretive facility for the national monument (see "Visitor Services/Interpretation Plan" section). With the roads and trails proposed for the Bandera Crater area (described below), the preferred alternative provides access to the monument's largest, most interesting and significant volcanic crater. Proposed development in this area will also provide visitors an opportunity to see one of the most interesting ice caves and the historic trading post complex.

The Bandera visitor center will be constructed approximately .7 mile south of the NM 53 junction (see Bandera Crater Area DCP). The site is gently sloping, in view of a prominent lava flow to the east, and just below the northeast side of Sandstone Ridge. The building site also has a northeast exposure, is dotted with evergreen trees and shrubs, and has sparse native grasses. The site faces a lava-edge ecotone of pinyon, juniper, and aspen trees that outline the west side of the lava flow. Major views from the site include Lava Crater, Cerro Candelaria, Sandstone Ridge, and the surrounding forest and meadows.

The visitor center will be representative of regional vernacular architecture. The grounds of the visitor center will be landscaped with native plant materials. Views to the local peaks and lava flow will be used in the design. A view deck on the east side of the visitor center will be oriented to these views and provide a designated area for interpretive talks relating to the resources. Parking will be screened with existing shade trees where feasible to soften the intrusion of the pavement. The design of the building will also take full advantage of the site's potential by using passive solar energy. The entryway will be easily distinguishable and offer basic visitor information.

The approximately 7,500-square-foot center<sup>4</sup> will be handicap accessible and include the following (a detailed discussion of the size and functions of the proposed visitor center is included in appendix F):

- an information/reception/circulation area, with an information desk

- a sales and publications display area, with storage and workspace

- an auditorium/AV room

- an exhibit room, with AV units in alcoves and/or as part of the exhibits

- NPS office space/workrooms and small storage area (for facility and district ranger personnel)

- a view deck, with a trailhead for a short interpretive trail to the margin of the nearby lava flow

- access to a trail to the top of Sandstone Ridge

- public restrooms

Access to the center will be a new two-way paved road off NM 53, approximately 1.3 miles east of the existing access road to the trading post. This new two-way road will be designed for cars and tour buses and will bring all visitors to the new visitor center just below the northeast side of Sandstone Ridge.

Two trails will begin at the visitor center. A nature trail east of the building will wind approximately .5 mile along the lava flow ecotone. This trail's purpose will be interpretive, bringing visitors in close contact with the variety of trees and shrubs and the jagged aa lava. A second trail will be constructed to the top of Sandstone Ridge where

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4. If the proposed Zuni Canyon Tourist Railroad (described under "Regional Recreation Resources and Use" in the "Affected Environment" section) is demonstrated to be feasible and is subsequently developed, certain modifications in the proposed facilities for the Bandera Crater area may be required. The railroad could increase the number of recreationists who would frequent the Bandera Crater area, which might require larger facilities than are currently proposed. Depending on the proximity of the terminus to the Bandera visitor center, it may be necessary to consider an increase in parking space and to develop a means of transportation between the terminus and the visitor center. If the preferred alternative is initiated, the National Park Service will work closely with local officials to ensure that the railroad will not compromise the quality of the visitor experience or the preservation of resources in the Bandera area.

there would be splendid panoramic views of the local craters, including **Bandera Crater** and **Lava Crater**. Mount Taylor (near Grants) and several areas on the east side of the monument would also be visible. This trail will continue on to the trading post, and another trail will branch southward to Spattercone Valley (see **Bandera Crater Area DCP map**).

Two-way traffic will end at the visitor center parking area, but a one-way paved tour road will continue 2.0 miles farther to a second new parking area just east of the trading post. This new parking area (designed in two or more small areas and not one large area) will be selectively sited to reduce impact on the natural vegetation, deter erosion, and prevent visual impact on the historic scene. This new parking area will have about the same capacity as the parking area at the proposed **Bandera** visitor center (37 cars). The existing historic parking area will not generally be used for parking vehicles, but may be used as a drop-off zone for maintenance supplies and emergency operations. The tour road will be designed for slow traffic speeds (25 mph) and tour buses; the need for pullout parking for scenic vistas will be considered during design. Careful alignment will be necessary to incorporate scenic vistas while minimizing disturbance of the easily erodible hillsides and natural vegetation as the road winds around Sandstone Ridge. Minimal interference with the natural water drainage along the lava flow margins will be incorporated into road design. This one-way road will enable visitors to approach the volcanic terrain of the area in a leisurely manner. A small picnic area with at least one wheelchair-accessible table will be provided near the trading post parking area. Both picnicking and parking represent a continuation of past and existing functions in this area.

The one-way tour road will continue .8 mile from the parking area near the trading post to NM 53 on an alignment that on the southern end is slightly east of the existing road. There will be lockable gates at the beginning of the one-way tour road and at the tour road exit to NM 53 to aid in management operations and resource protection.

There will be one intersection on the one-way tour road, which connects to a two-way .3-mile paved spur road to parking and a trailhead for Dripping Lava Cave and Lava Crater. The existing one-lane dirt road crosses a narrow segment of lava; it will be necessary to widen this crossing for two-way

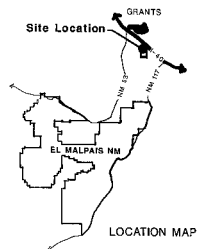
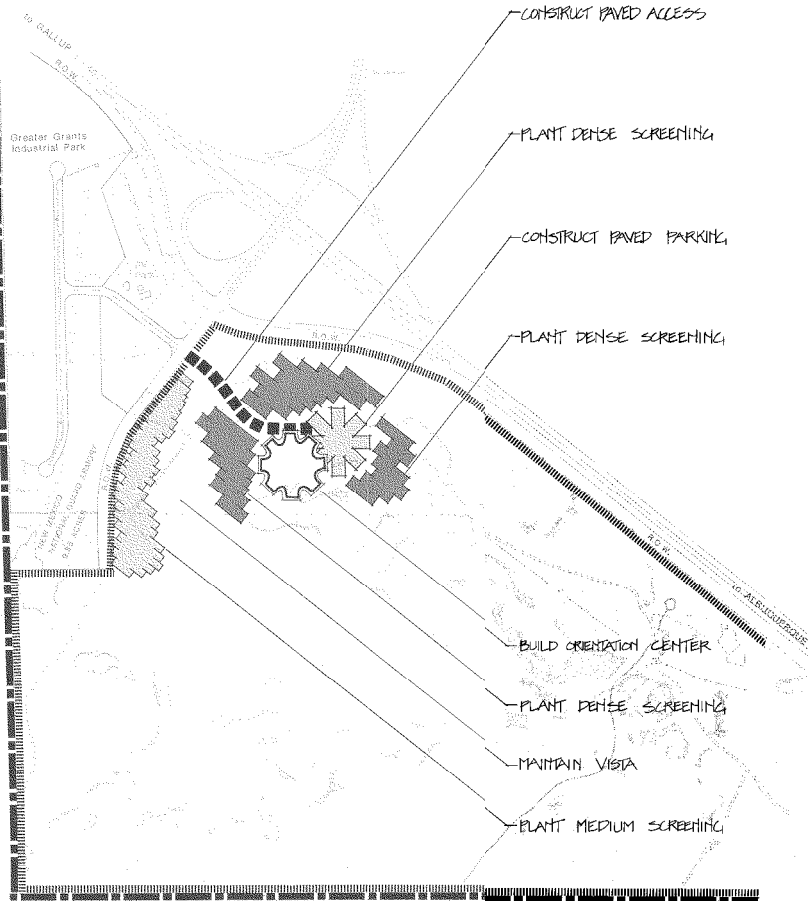
traffic. A new trail to Dripping Lava Cave and catwalk-like steps will descend into the precipitous entrance and continue to the end of the cave past features that include a perennial ice pond and dripping lava formations. (Dripping Lava Cave is one of the best opportunities in the monument for visitors to experience an underground “big cave.”) Electric lighting will be installed or the Park Service will provide lanterns or flashlights to use in the cave.

A trail climbing southward to the rim of Lava Crater will branch from the trail to Dripping Lava Cave. Because of the rough terrain at the rim of Lava Crater, this trail will not be a loop. (See **Bandera Crater Area DCP** and also the “Visitor Services/ Interpretation Plan” section for representations of the entire trail system proposed in the **Bandera Crater area**.)

To accommodate increased visitation and additional interpretive services, the existing Candelaria trading post will be rehabilitated in a manner compatible with its past history and function and used as a staffed/unstaffed information center for orienting visitors to the **Bandera** area and trail system. This historic structure may also serve as a shelter in inclement weather or as a meeting place for special events, school or bus tour groups, etc. The interior will be brought up to NPS health and safety standards. Although the narrow doorways and other structural features of the trading post currently make wheelchair accessibility difficult, it is a goal of the general management plan to provide handicapped visitors physical access to this structure.

However, prior to any modification of the structures or historic setting, a historic structures report will be prepared to document and analyze all periods of construction and modification, building techniques, source materials, evidence of use, and historic setting of the buildings, grounds, and related structures. Once the buildings have been brought up to NPS standards, a historic structures preservation guide will be prepared to direct preservation maintenance activities and provide orderly and timely inspection and upkeep of the structures.

Because the trading post complex (including the Ice Cave and **Bandera Crater**, which are used for religious purposes by the Zuni) is thought to be eligible for inclusion on the National Register of Historic Places for its significance in early-day New

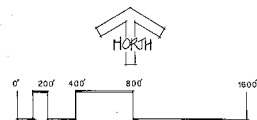


## MULTIAGENCY CENTER DCP

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

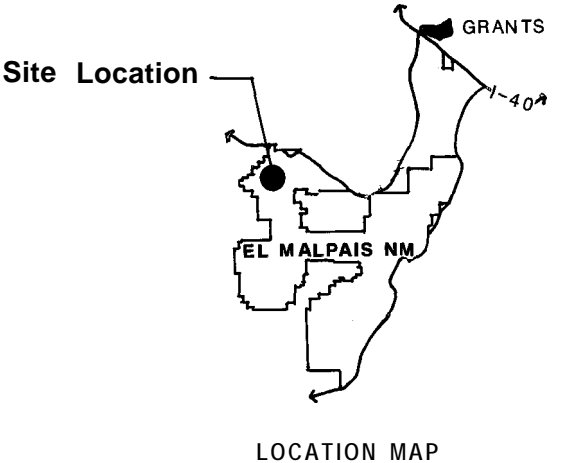
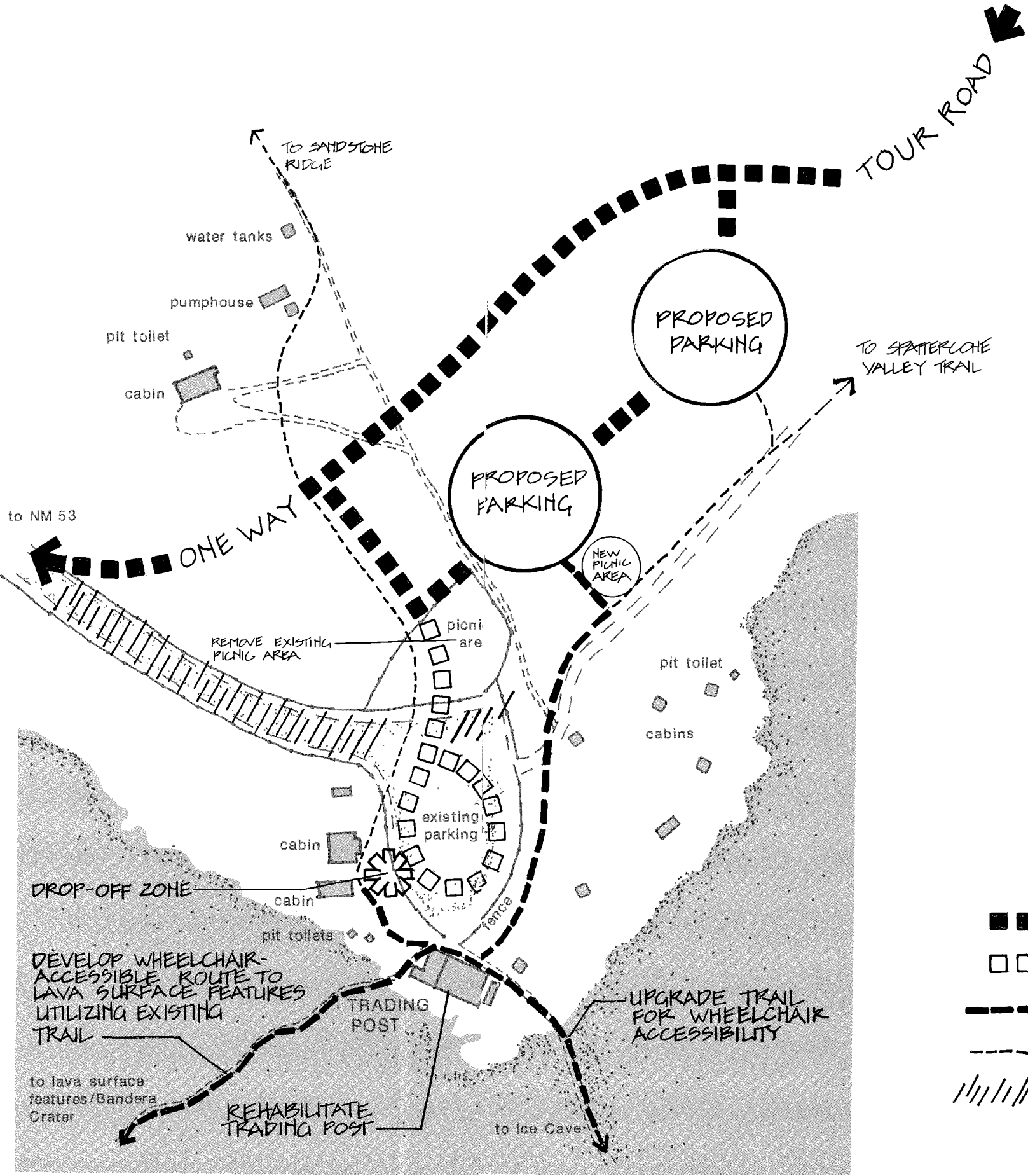
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LEGEND  
 NPS MONUMENT BOUNDARY  
 BLM CONSERVATION AREA BOUNDARY



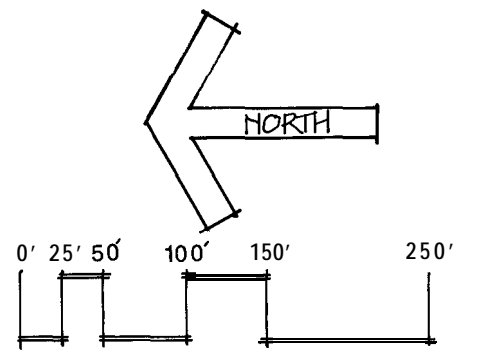
NOTE:  
BOUNDARY LINES, ROAD, PARKING, BUILDING LOCATIONS ARE  
APPROXIMATE. ACTUAL ALIGNMENTS TO BE DETERMINED.





**TRADING POST AREA DCP**  
**EL MALPAIS NATIONAL MONUMENT**  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE  
DSC/DEC 1989/103/20.019A

- LEGEND**
- PROPOSED PAVED ROAD
  - PROPOSED GRAVEL SERVICE ROAD
  - PROPOSED WHEELCHAIR-ACCESSIBLE TRAIL
  - HIKING TRAIL
  - OBLITERATE & REVEGETATE ROAD



Mexico tourism and for its traditional cultural importance to the contemporary Zuni, proposals for adaptive reuse and other modifications will be developed in consultation with the New Mexico State Historic Preservation Office, the Advisory Council on Historic Preservation, and American Indians prior to any structural or landscape changes.<sup>5</sup>

Two of the former tourist cabins will be rehabilitated and adaptively reused as restrooms, and another cabin will be stabilized, fitted with period furnishings (using existing furnishings to the extent possible), and interpreted as an example of an early-day tourist cabin (see Trading Post Area DCP). The exteriors of all of the original tourist cabins will be preserved, consistent with the historic structures preservation guide. All structures to be rehabilitated in the trading post area will be treated consistent with the secretary of the interior's "Standards for Rehabilitation." After compliance with section 106 procedures, noncontributing structures, including pit toilets, will be removed.

There will be a wheelchair-accessible trail between the parking area and the trading post. This trail and others described below will be carefully blended with the historic scene and compatible in materials and design; they will also meet NPS safety standards for the type of trail proposed (see appendix D on trail standards). Signs in the area of the trading post will be visually compatible with the setting.

The existing trail from the trading post to the Ice Cave will be improved, interpreted, and made wheelchair-accessible; this will require some regrading and use of ramps in short sections to meet the necessary standards. The steep wooden stairway into the Ice Cave will be replaced using compatible materials and design, keeping with the natural and historic scene and conforming with Uniform Federal Accessibility Standards. There will be a platform provided at the rim or in conjunction with the stairway structure so that visitors in wheelchairs can see the interior portions of the cave. These modifications will not be inappropriate, considering the 50-year continuum of changes in these features to facilitate visitor use.

A new wheelchair-accessible loop trail from the trading post to nearby lava surface features (spattercone and tree molds) will be provided and principal features interpreted; much of this trail will be on an existing alignment. The existing trail to **Bandera Crater** (the old motor tour route) beyond the spattercone will also be maintained and interpreted as part of the historic scene. The trail to **Bandera Crater** is composed of relatively loose cinder, which is subject to unsightly damage including scarring of steep slopes and loss of bedrock when visitors leave established trails. Signs will be posted on the trails where necessary for visitor safety and resource protection. Unauthorized off-trail use in the **Bandera** area will be monitored and controlled to minimize scarring and erosion of fragile cinder slopes. Using existing alignments of the Ice Cave and **Bandera Crater** trails, portions of which will be wheelchair accessible, is a significant mitigation in reducing disturbance of geologic features and cultural resources in the **Bandera** area and maintaining the historic scene.

There will be interconnecting trails to Spattercone Valley, Sandstone Ridge, and **Bandera Crater** (see **Bandera Crater Area DCP**). There will also be a new trail from the Ice Cave that intersects the trail to the summit of Cerro **Bandera** (described below in the description of East Rendija).

It is crucial that new construction such as trails and landscaping in the vicinity of the trading post exhibit a sense of unity and a sound functional relationship with the existing architectural elements of the trading post and cabins as well as with the natural landscape. That is, any new structures near the trading post will be compatible in form, style, mass, color, material, texture, and scale with the old.

An abandoned sawmill site, dumps, and ruins of cabins historically associated with the regional lumber industry are in the vicinity of the proposed visitor center in the **Bandera** area and will likely be obliterated by construction. Archeological testing and documentation will be completed prior to the final comprehensive design for the visitor center, and the sites will be mapped to document their location, size, and arrangement. It has been determined in consultation with the New Mexico

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5. National register forms are being prepared.

State Historic Preservation Office that these sites are not eligible for nomination to the national register.

Stone circles in the vicinity of **Bandera Crater** will be stabilized and interpreted to visitors as part of the area's prehistoric heritage.

To provide the facilities essential for interpreting and protecting the **Bandera Crater** area and other western portions of the national monument, four single-family residences, a four-unit apartment building, a four-bay maintenance building, and parking and utilities for monument personnel and maintenance operations will be built. Employees residing in monument housing will provide a 24-hour presence that will help deter vandalism and theft, and staff will be well positioned to make after-hour gate closures and respond to emergencies. The residences and maintenance facilities will be behind a forested hill, about .5 mile east of the visitor center (see **Bandera Crater Area DCP**). This location is within walking distance of the visitor center, yet it is fully screened from visitors by topography and forest. These buildings and associated facilities will be accessed from NM 53 by a new paved service road, about 1.3 miles east of the new visitor center entrance road. This road will skirt the western edge of a large open meadow at the base of a small bluff, then turn westward toward the proposed residential and maintenance area.

The architecture of the residences and apartment building will be consistent with the regional vernacular style and also use passive solar energy. Colors and materials will blend with the immediate environs. Each residence and the apartment building will have exterior landscape elements delineating private, semi-private, and community space. Minimal disturbance of natural vegetation will be a top priority in locating each structure and the parking areas. Careful attention will be taken to screen the residential area from the noise and visual intrusions associated with the maintenance area.

The maintenance area will be near the residential area for emergency responses and will consist of an elongated single-story structure with four parking bays, a workshop, a small office, and rescue/fire cache storage. The building will be of regional vernacular architecture, with materials and colors that blend with the immediate environs (the site

may be visible from public trails at Lava Crater and Sandstone Ridge). The design will use passive solar energy. Parking for most maintenance vehicles will be adjacent to the building, and the perimeter of the parking area will retain large trees and shrubs. Because of the often harsh winters, indoor parking space is needed for selected vehicles to ensure dependable operations during periods of cold weather and to retard the deterioration of the equipment. Heated and well-ventilated indoor work areas will be incorporated in the design to provide work space during winter months. A security fence will probably enclose the maintenance compound.

The cinder and borrow pits in the **Bandera** area will be recontoured and restored to natural appearance.

### **East Rendija Area**

Although the **Bandera Crater** area contains many spectacular volcanic features for visitors to see, the East Rendija area complements it with an array of lava surface and lava tube features that are not seen near **Bandera Crater**. These include a massive lava wall, enormous caves with "windows," and other phenomena that illustrate the dynamics of fluid lava.

Beginning northwest of Cerro **Bandera** and leading south from NM 53 will be a new, 6-mile, two-way, gravel-surfaced road that will lead to the Cerro **Bandera** trailhead and on to East Rendija (see East Rendija Area DCP). Several segments of the road will be elevated to avoid major maintenance problems, provide proper drainage (i.e., to prevent pooling on the roadway), and ensure reliable access to East Rendija by two-wheel-drive vehicles. The northernmost 2 miles of Route 42 east of Cerro **Bandera** will be completely realigned to the west side of Cerro **Bandera**, which will improve the dangerous sight distance at the NM 53/Route 42 intersection; the existing 2 miles of Route 42 east of Cerro **Bandera** will be closed (to eliminate views of vehicles and dust seen by visitors at **Bandera Crater**), and the abandoned section will be restored to its natural condition. The middle 2 miles will join the old alignment of Route 42 south of Cerro **Bandera**, and the last 2 miles will depart from Route 42 and approach East Rendija on the north side of Cerro Rendija (replacing the primitive high-clearance road that now exists). The southernmost 4 miles may or may not follow

existing alignments; however the entire 6 miles will stay at least .25 mile inside the monument boundary. (The first mile of this new road may require a future administrative boundary adjustment to be included inside the monument.

Along the road to East Rendija, new access and gravel parking will serve a new trail that ascends the western side of Cerro **Bandera** to its summit – the highest point in the national monument and a splendid 360-degree view of the surrounding region. The trail (about 1 mile) will require cutting some slopes of cinder and volcanic agglutinate. This will be mitigated by confining the **treadway** to areas of relative stability, selecting an alignment to minimize shortcutting, and by using side-tread logs, drainage bars, and retaining walls to minimize downslope loss of loose cinder.

A new 6-site (expandable to meet demand) primitive vehicular campground with tables and grates will be built east of the cutoff to East Rendija from Route 42 (see East Rendija Area DCP). The campground will be located on a site with good drainage (but not more than 3 percent slope) and will use existing trees for shade where possible. Each campsite will accommodate at least two vehicles and a maximum of eight people and will be designed to concentrate eating and sleeping activities in comfortable, well-drained areas. Ample spacing and native vegetation between sites will minimize noise and visual intrusions. Parking will be graveled, and there will be vault toilets at the campground. No water will be provided in this portion of the monument.

There will be a roadside **pulloff** and gravel parking area to serve a new loop trail to the lava wall feature prior to reaching East Rendija.

A gravel parking area and trailhead will be built at the end of the improved road to East Rendija. Vault toilets will be provided at the trailhead. New trails will be developed to Big Skylight and Four-Window caves, using flat lava surfaces for treadways wherever possible to promote safety and minimize resource damage. Access at appropriate standards will be provided into the caves. There will be primitive marked routes beyond these two caves to Seven Bridges and Caterpillar collapses. These trails will be marked, not constructed, and high-density recreational use in these areas with fragile resources will be discouraged.

## **Braided Cave**

This area provides yet another type of volcanic feature – a lava tube that has numerous reconnecting passages and colorful dripping lava features on the walls and ceilings. Road access to Braided Cave will be the existing primitive routes, except that the road just north of the cave will be gated just inside the monument boundary to prevent further vehicular access by the public. An unimproved dirt parking area will be provided at the gate, and visitors will follow a marked route to Braided Cave. No toilets or water will be provided.

## **El Calderon Area**

Several important lava tube features not present elsewhere in the monument are concentrated in the El Calderon area. These include the long Junction Cave, the deep impressive Double Sinks (caused by collapse of an underlying lava tube), and the well-known Bat Cave that is summer habitat of a large colony of Mexican free-tailed bats.

The existing dirt road to Junction Cave from NM 53 will be partly realigned and improved as a gravel road; a small parking area and trailhead will be provided near Junction **Cave**. The route to the entrance of Junction Cave will be marked, but visitors will explore it on their own. The new gravel road will be extended south from Junction Cave to a new formalized gravel parking area about .3 mile northeast of Bat Cave. Existing primitive roads in the area of Bat Cave will be closed and restored to natural conditions (see El Calderon DCP).

A new .3-mile trail will be built south to Bat Cave, and a new .2-mile trail will lead north to Double Sinks, both trails starting at the new parking area. There will also be a .2-mile trail from Double Sinks to Junction Cave (so that people can leave their cars at Junction Cave and walk to all three features). The trail to Bat Cave will be well marked and easy to follow under poor lighting conditions (the bat flights are at dusk). Vault toilets but no water will be provided at the new parking area. The east tube of Bat Cave will be closed for reasons of visitor health and safety and to protect the bats; viewing of the evening bat flights will be allowed

only from a safe distance in an area designated for that purpose. Exploration of the western tube at Bat Cave will not be encouraged because of its proximity to the east side, which is occupied by the bats. The preferred alternative allows continued viewing of the bat flights (an existing use) and also considers visitor safety and health and the sensitivity of the bats and their habitat. Studies to be initiated by 1991 call for a baseline biological study including population dynamics of the bat colony. It is the opinion of several scientists that public viewing of the bat flight is highly unlikely to have any disturbing effect on the colony. Unless the baseline study demonstrates an adverse effect, the preferred alternative relating to improved access to Bat Cave will be carried out.

The "Corral road" (northwest of El Calderon) will be kept open until improvements are made on the alternate road just north of El Calderon to support all local through-traffic leading south to the national conservation area. When these improvements are made, the Corral road will be closed and restored to natural conditions.

### **Zuni-Acoma/Acoma-Zuni Trail**

This 7-mile trail, a marked foot route across four of the five most recent lava flows of the monument, illustrates many surface lava flow features and gives visitors the opportunity to understand what crossing these badlands was like for prehistoric peoples and historic expeditions.

The access road from NM 53 into the parking area on the west side of the trail will remain as existing, but the gravel surface of the parking area will be maintained at a higher standard and the parking islands will be revegetated. The trail from the west end parking area to the viewpoint will be regraded and hard-surfaced to provide wheelchair access and will blend with the surrounding lava. There will be no toilets or water provided at the trailhead (see Zuni-Acoma DCP).

The east end of the trail is not in federal ownership (see description of existing trails in the "Affected Environment" section). If possible, an easement will be acquired from the Acoma for a trail, trailhead, and a small parking area at the east end of the trail.

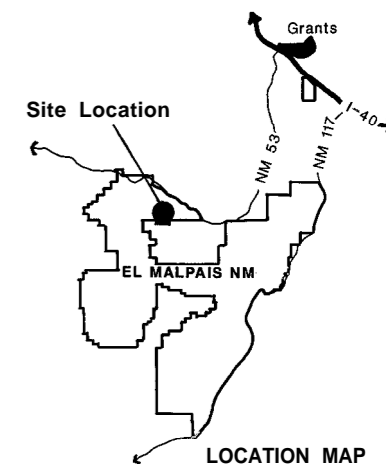
### **Las Ventanas**

The Las Ventanas site is one of the southernmost outliers of the major prehistoric Chacoan system and was an important regional center to the Chaco people. With its tower kiva and great kiva, Las Ventanas stands impressively on the edge of the sandstone bluffs that overlook the El Malpais lava flows. In 1981, the partially excavated tower kiva was backfilled by the Park Service and the Archeological Conservancy to prevent deterioration of the walls.

Las Ventanas is cited in the establishing legislation as an important site for visitor enjoyment and understanding of the Chaco culture; however, it is also special to the Acoma. The preferred alternative seemed the only feasible compromise for development at the site. Although a trail is proposed under the preferred alternative (see Sandstone Bluffs/Las Ventanas DCP and following description), the visitor experience will be controlled because of ranger patrols, carefully aligned and marked paths, and wayside exhibits that will explain the importance of staying on the trails and respecting the resource. The Park Service has chosen to present two options for Las Ventanas. The difference between the two options is only the manner in which the tower kiva will be presented for public viewing.

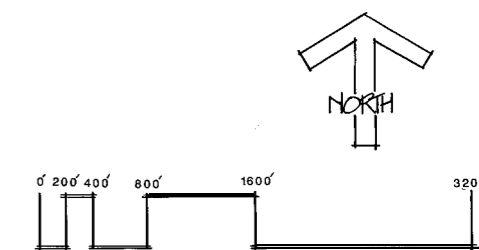
**Option 1.** For visitor access to Las Ventanas, a new .5-mile paved spur road will be built west of the first curve in the Sandstone Bluffs road. The spur road will lead to a paved parking area. Access to Las Ventanas will be by a 1.3-mile trail that begins at the parking area and continues northward along the sandstone rim to several features – a large natural arch, viewpoints of El Malpais, a prehistoric roomblock associated with Chacoan habitation of the area, the tower kiva and great kiva, and traces of a prehistoric road. Neither kiva will be excavated or stabilized. The trail will be carefully routed to avoid impacts on cultural resources or native vegetation. (Interpretive exhibits with photographs will show how the tower kiva looked before it was backfilled by archeologists in 1981.) There will be no access to the Las Ventanas trail at night, controlled by the gate on the Sandstone Bluffs road at NM 117 (see below). This gate will offer more control and protection of the Las Ventanas site.

**Option 2.** This option is identical to option 1 except the backfill will be carefully removed from the tower

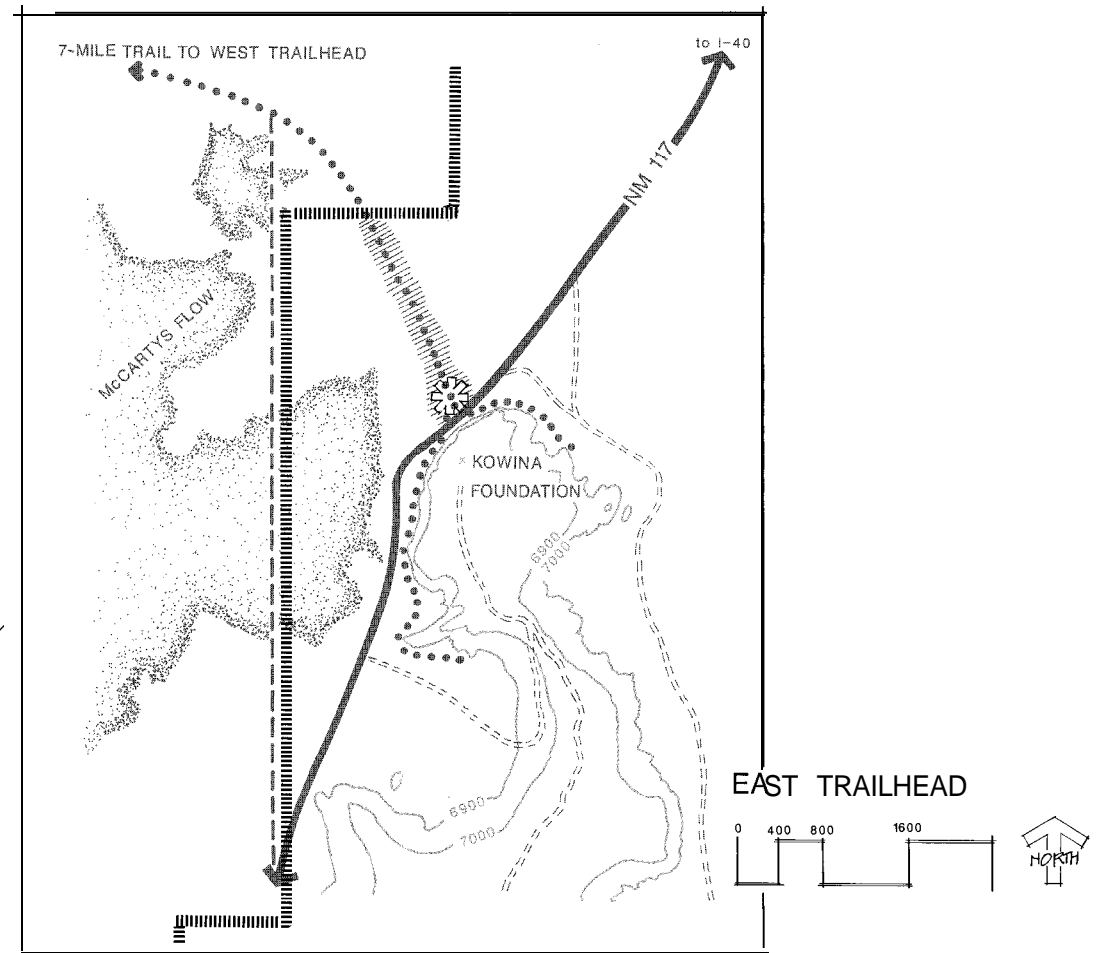
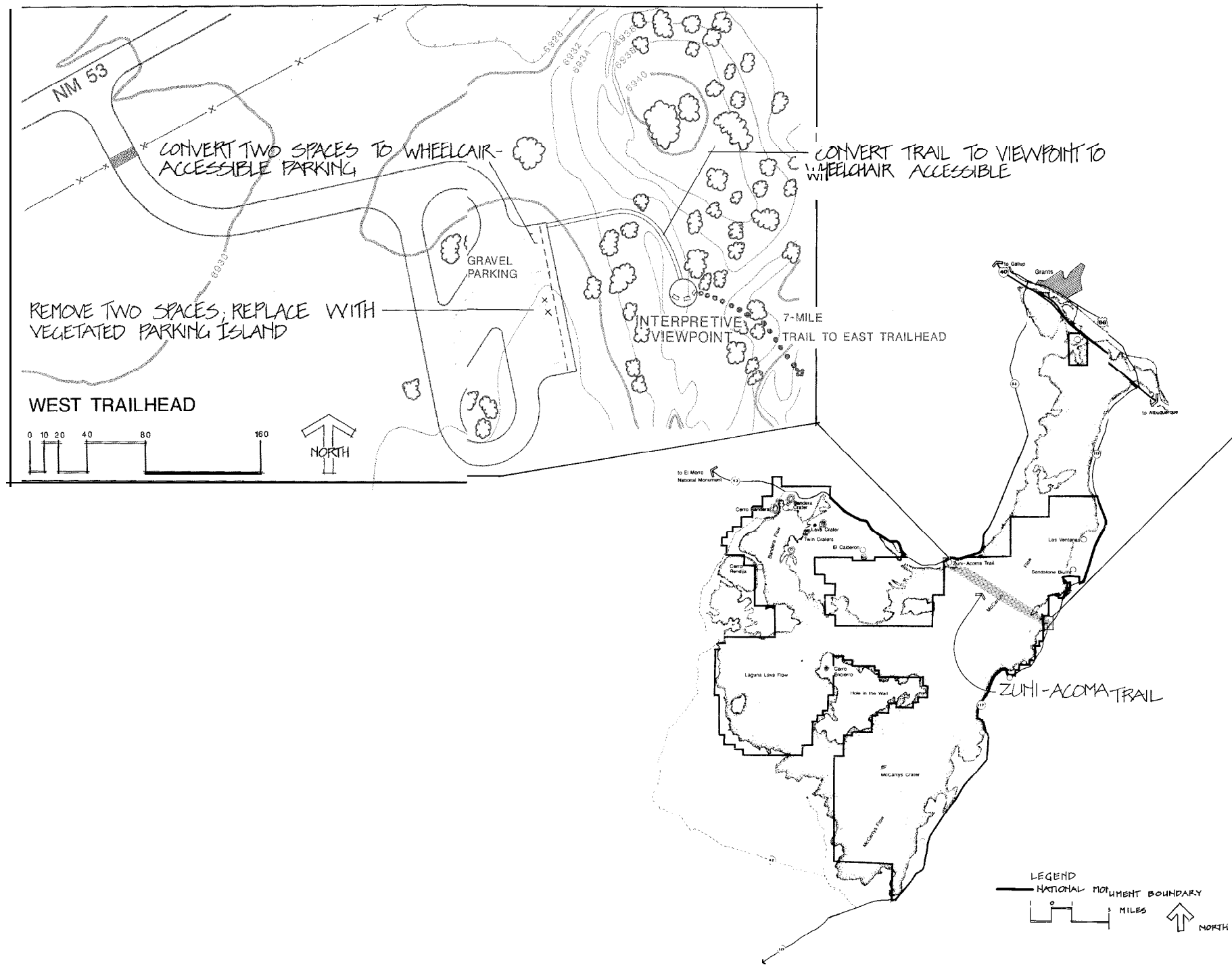


# **EL CALDERON AREA DCP** **EL MALPAIS NATIONAL MONUMENT** U.S. DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE DSC/DEC 1989/103/20,015A

- LEGEND**
- PROPOSED GRAVEL ROAD
  - \*==\*==\*==\* CLOSED ROAD\*
  - - - - - PROPOSED TRAIL\*\*
  - ⊗ PROPOSED GRAVEL PARKING
  - ⊗ NATURAL/CULTURAL FEATURE



\* CORRAL ROAD WILL BE CLOSED AFTER IMPROVEMENTS ARE MADE TO EL CALDERON ROAD.  
 \*\* TRAIL ALIGNMENT IS APPROXIMATE. ACTUAL ALIGNMENT TO BE DETERMINED.

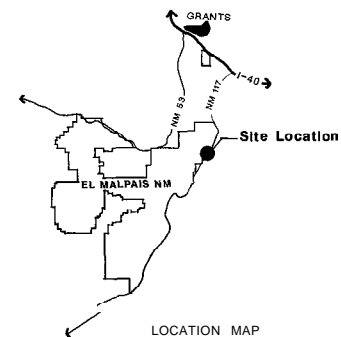


# **ZUNI-ACOMA TRAIL DCP** **EL MALPAIS NATIONAL MONUMENT** **U.S. DEPARTMENT OF THE INTERIOR** **NATIONAL PARK SERVICE**

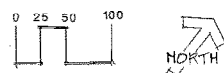
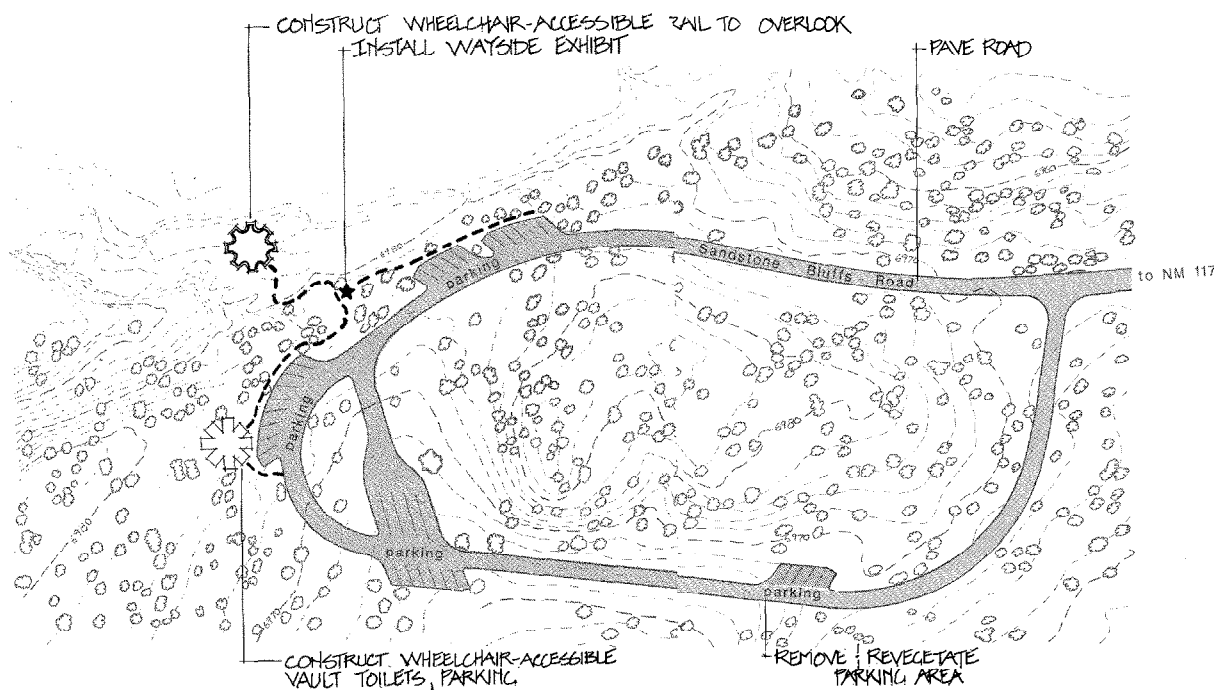
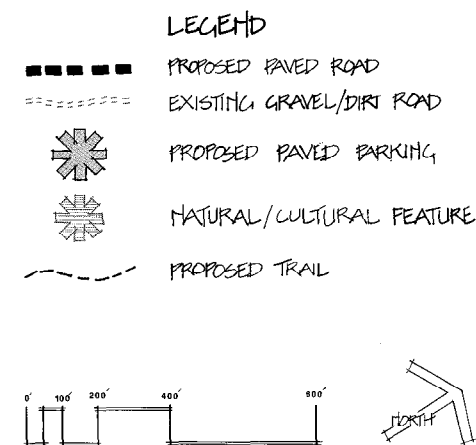
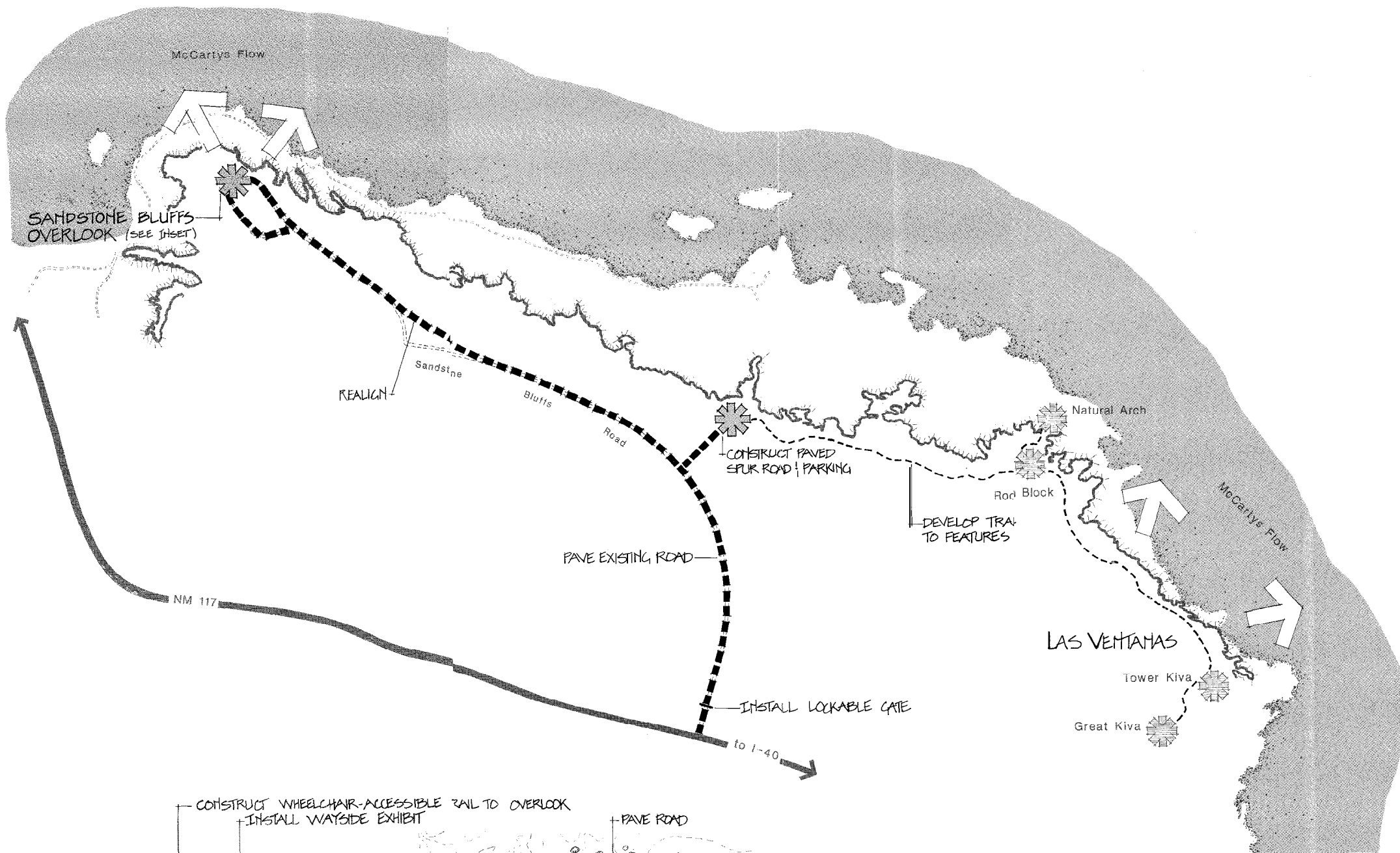
DSC/JULY 1989/103/20.016

- LEGEND**
- ===== NPS MONUMENT BOUNDARY
  - ////// PROPOSED EASEMENT \*
  - ⊗ PROPOSED PARKING \*
  - ..... PREHISTORIC TRAIL
  - PRESENT NPS CONNECTOR TRAIL

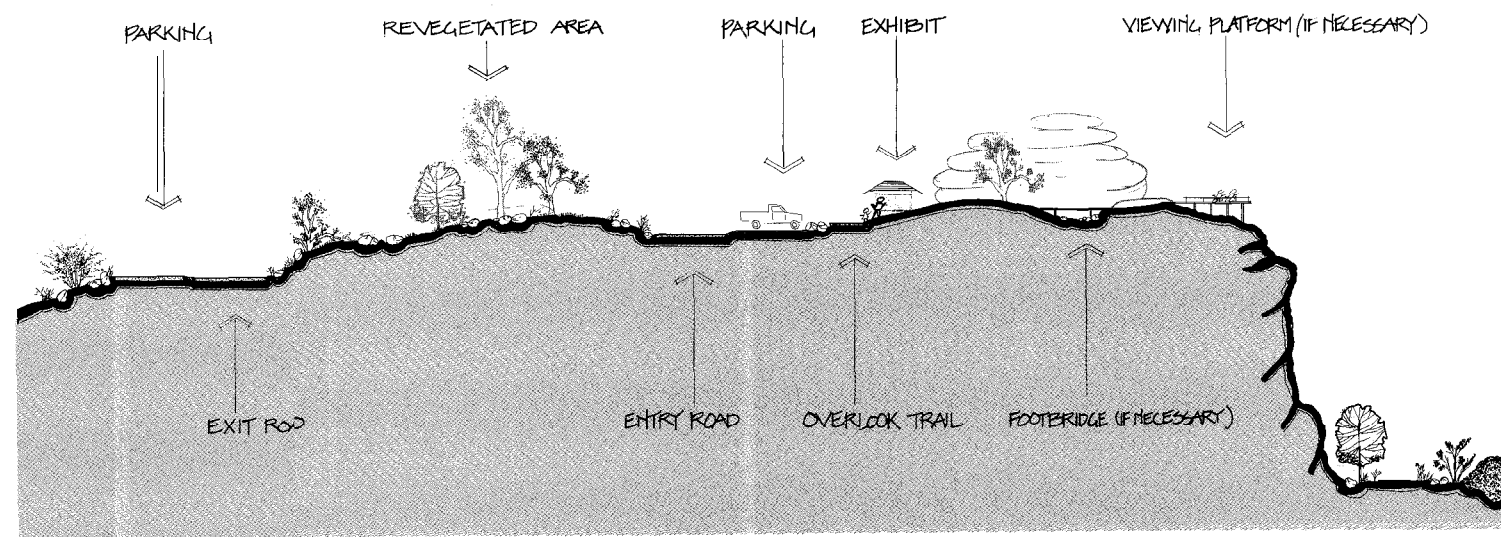
\* BOUNDARY, EASEMENT, TRAIL ALIGNMENTS ARE APPROXIMATE. ACTUAL ALIGNMENTS TO BE DETERMINED.



# **SANDSTONE BLUFFS / LAS VENTANAS DCP** EL MALPAIS NATIONAL MONUMENT U.S. DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE DSC/JULY 1998/103/20,012



PLAN VIEW - SANDSTONE BLUFFS



SECTION - SANDSTONE BLUFFS (NO SCALE)

kiva and the circular outline of the base of the kiva will be stabilized to give visitors a direct view of the character of the structure.<sup>6</sup> However, this option will entail significant expense and possible damage to the resource.

Following fill removal, masonry will be stabilized, drainage will be controlled, and measures will be developed to help protect exposed artifacts from erosion and vandalism. Cyclic maintenance will be necessary. This work will be guided by a recognition of the archeological, architectural, and religious importance and integrity of the site.

Because Las Ventanas is listed on the National Register of Historic Places, consultation with the New Mexico State Historic Preservation Office will be necessary prior to implementation of this option.

### **Sandstone Bluffs Overlook**

This overlook provides the only opportunity for visitors to orient themselves to the principal landscape features of the monument by looking out over the lava flows. To continue and improve this traditional visitor use, the existing gravel-surfaced road to Sandstone Bluffs from NM 117 will be paved under the preferred alternative, with one sharp curve realigned to improve vehicular safety. (As mentioned above, there will be a new spur road from this road to the parking and trailhead for Las Ventanas.) The parking area at Sandstone Bluffs overlook will be modified and paved, and wheelchair-accessible vault toilets will be added adjacent to the wheelchair-accessible parking spaces. Trampled areas will be revegetated and native vegetation protected. The loose soils in the area will be stabilized with engineering fabric and base aggregate.

A wheelchair-accessible trail to the overlook will be provided. The trail will be as compatible as possible with the sandstone outcrops, and cutting sandstone surfaces to accommodate the trail will be avoided to the greatest possible extent; smooth, well-drained

natural sandstone surfaces will be used in level areas if possible. The trail will possibly end at the viewpoint at a stone or concrete structure large enough to contain wheelchairs and accommodate other visitors – need for this structure would be determined during trail design. All facilities will be designed to minimize visual intrusion on this sandstone landscape while providing easy access and safety (see Sandstone Bluffs/Las Ventanas DCP).

There will be a lockable gate on the Sandstone Bluffs road at NM 117 that will be closed at night, thereby helping protect the visitors and resources in this area.

Several old stone buildings in the vicinity of Sandstone Bluffs will be evaluated for their significance and integrity – possibly as part of a historic resource study (see “The Plan for Cultural Resources Management” section).

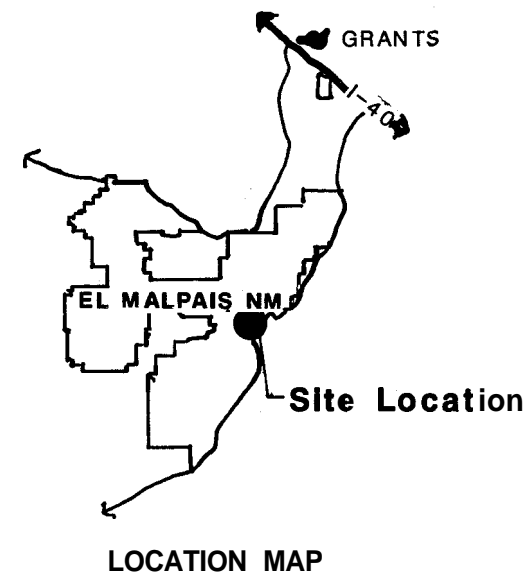
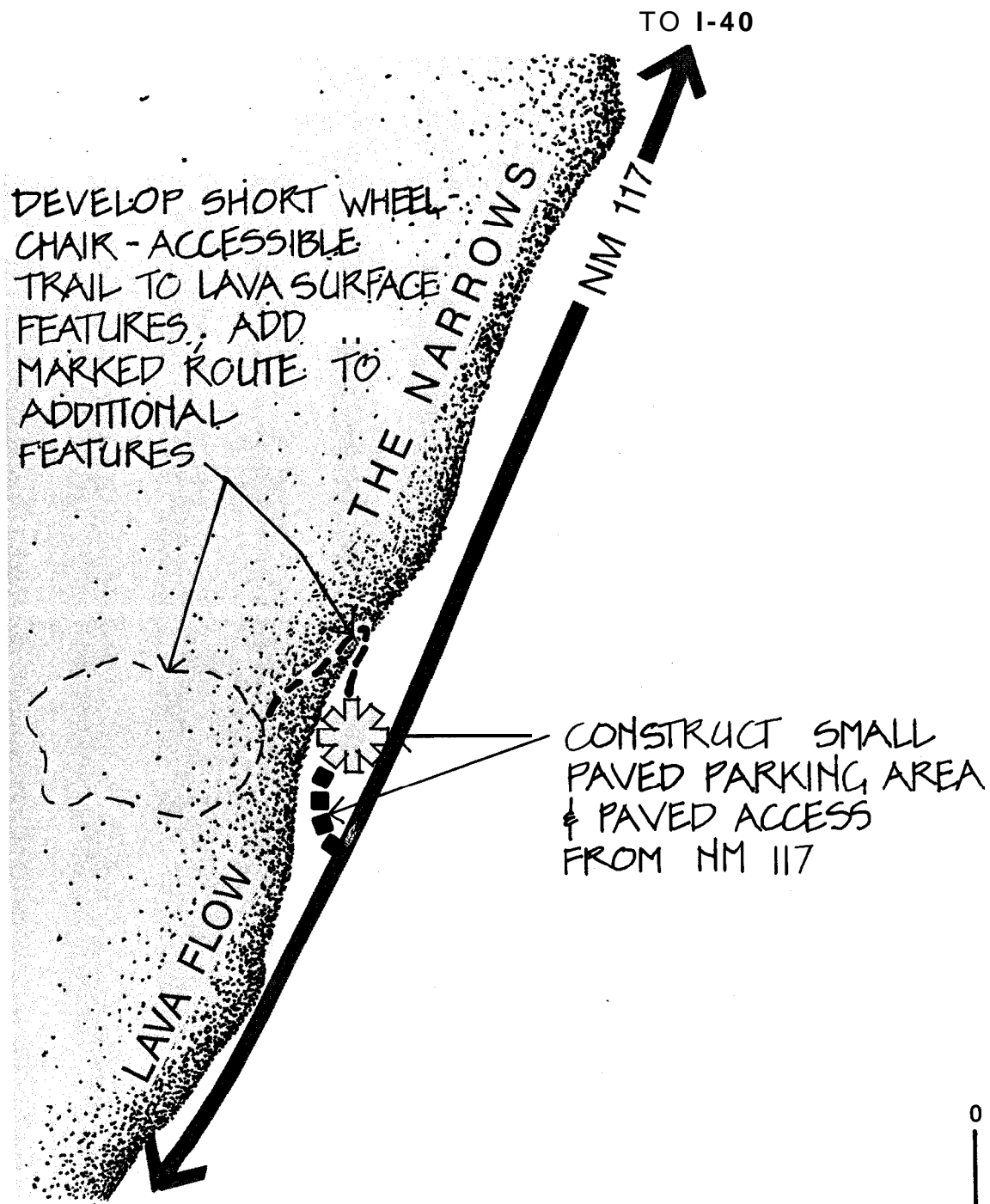
### **The Narrows**

Several areas along NM 117 were examined as potential sites for visitor access onto the impressive McCartys lava flow. All but one – the Narrows – were rejected because of fragile biological resources or the presence of areas important to the Acoma Indians. There will be a small near-road paved parking area for about six vehicles at the Narrows. Because the lava edge adjacent to the road pools surface water after storms, adequate drainage will be incorporated into the final design.

A short wheelchair-accessible ramp and boardwalk for viewing the lava surface features and dwarf trees will lead onto the McCartys lava flow. The boardwalk will allow visitors in wheelchairs to experience a few representative lava features in a short distance. Beyond this point, because of topographic constraints, the trail will not be wheelchair accessible. However, an additional marked loop trail will continue onto the adjacent pahoehoe flow area (see The Narrows DCP).

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6. It should be noted that there are other examples of Chacoan Outliers open to public view in northern New Mexico. However, this option would provide a viewing experience for visitors at El Malpais.



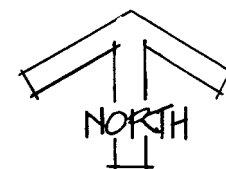
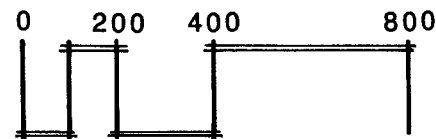
# THE NARROWS DCP

## EL MALPAIS NATIONAL MONUMENT

### U.S. DEPARTMENT OF THE INTERIOR

### NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,018



## McCartys Crater Viewpoint

The natural appearance of this area is already disturbed because of a quarry, and extensive work will be needed to rehabilitate the site.<sup>7</sup> However, this is the most impressive place in the monument to see the source of the immense McCartys flow from its small crater. Thus, the Park Service is presenting two options for McCartys Crater viewpoint.

**Option 1.** A new .1-mile spur road from NM 117 will terminate at a new paved parking area and trailhead. A short trail will be developed to a viewpoint overlooking the lava flow and McCartys Crater (see McCartys Crater Viewpoint DCP). Also, an orientation wayside will be placed near NM 117 to inform northbound visitors of the features ahead in the national monument and conservation area.

**Option 2.** Alternately, there will be no access or development at McCartys Crater viewpoint. No action would preclude the impact of construction and eliminate the risk of visitors walking beyond the viewpoint into areas that may contain unexploded ordnance.

## Roadside Kiosk Along NM 117

Provided option 2 (no development) is selected for McCartys Crater viewpoint, an orientation/information kiosk will be built near the south entrance of the monument/conservation area along NM 117 (refer to General Development – Preferred Alternative map). The kiosk, an open-air/shade structure developed cooperatively by the Park Service and Bureau of Land Management, will have a paved parking area, be visually prominent yet compatible with the scenery, and provide visitor orientation to features ahead in the national monument/conservation area.

The Park Service will also join the Bureau of Land Management in planning for a kiosk on NM 117 near the north entrance to the monument/conservation area and/or for exterior exhibits at the BLM ranger station (described below).

## Other Facilities Along NM 117

The Bureau of Land Management's *Draft* General Management *Plan* proposes additional visitor use facilities along NM 117. These facilities are mentioned briefly here to give the reader an overall picture of all visitor activities along NM 117 (refer to General Development – Preferred Alternative map).

There will be a 2,700-square-foot ranger station/public contact station, with paved parking for about 30 cars and five RVs or busses and an interpretive trail that would highlight local flora and landmarks. Included would be an information/reception foyer, book sales and display areas, storage space, and office and residence for seasonal employees. A well would be drilled to provide water for restrooms and drinking water. The site is about 9 miles south of I-40 on NM 117 (in section 32, T 9 N, R 9 W). (The Bureau of Land Management would like to begin construction of the building in July 1990.)

There will be a new gravel parking area and loop trail to La Ventana natural arch. The trail will be wheelchair accessible to a photo point. Vault toilets will also be provided.

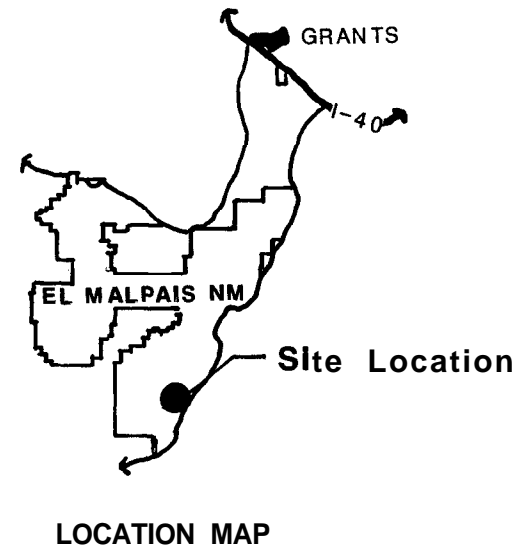
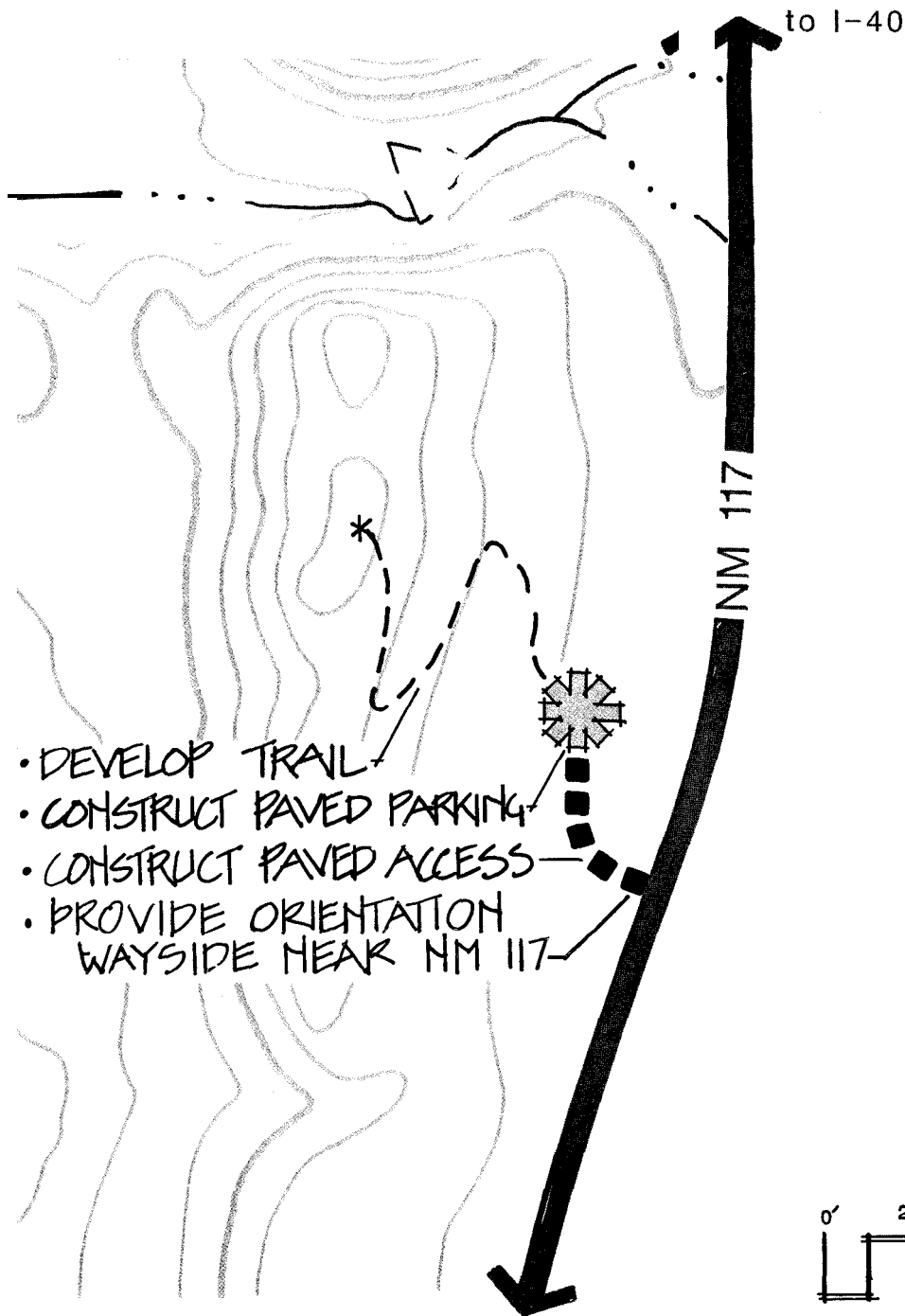
At the south end of the Big Narrows, the access will be redesigned and a gravel parking and picnic area provided. There will also be a trailhead and a trail leading into the Cebolla Wilderness.

Improved access will be provided to the Dittert archeological site; there will be gravel parking and a short trail to the site.

Also, the Pueblo of Acoma has expressed an interest in developing their Kowina Foundation property. Based on future consultation, the Park Service and the Bureau of Land Management could extend technical assistance to the tribe toward this objective.

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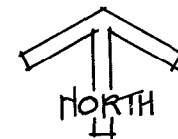
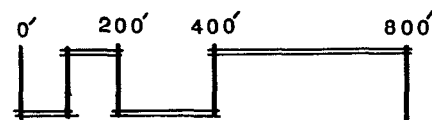
7. Because McCartys Crater is part of a past military bombing range, there is the remote possibility of unexploded ordnance in the area. The Park Service is negotiating deactivation and removal of all bombs and related objects from the area with the Department of Defense.



## McCARTYS CRATER VIEWPOINT DCP (OPTION 1)

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,021



## Concessions

Because of the close proximity of the monument to the communities of Grants, Milan, and Ramah, there is no need for concession facilities in the monument. The three communities provide adequate services for the projected number of visitors. Commercial services available in Grants/Milan/Ramah (merchandise sales, food and beverage service, motor vehicle fuels and service, and lodging) are currently not being used to capacity, and there is potential for considerable growth in the service sector of these communities, as well as on private lands closer to the monument.

Sales of publications relating to the monument and its interpretive themes will be undertaken at outlets in the two visitor centers by a nonprofit cooperative association. Currently, the Southwest Parks and Monuments Association has been authorized to assume this role.

## Facility Capacity

Recreation visits to the monument are projected to increase substantially during the next seven years, with the highest concentrations occurring in the Bandera Crater area. To accommodate projections, a new visitor center, roads, parking, and trails will be constructed at Bandera as described previously. The plan contains mitigations to confine visitors in such a way that resource damage will be minimized, and other areas will be monitored for adverse effects and steps taken as necessary to alleviate these effects.

The location of facilities, especially parking, greatly influences the use of frontcountry and backcountry areas. Parking areas will be located in sites with potential for expansion to help alleviate potential adverse effects on resources and the visitor experience. There will be at least 90 parking spaces dispersed in the general Bandera Crater area alone, including the visitor center. Trails in the Bandera Crater area will be designed for visitors with differing skills and preferences. Trails will be routed in loops, wherever feasible. More than 10 miles of trails will be available in the Bandera Crater area, and there will be more than 25 miles of trails available within the monument.

Table 1 itemizes the parking capacity along all monument road corridors once the preferred

alternative is implemented. These capacities are based on visitor projections for 1995. When the design phase for these facilities is initiated, the capacities will be reevaluated and, if necessary, adjusted in consideration of actual visitation and revised projections at that time. From these capacities, the theoretical maximum number of persons at one time (PAOT) was calculated by multiplying the average number of persons per car (2.8) times the number of parking spaces. (The NPS nationwide average is 2.8; El Malpais as yet has no data.) The PAOT has been rounded to the nearest "whole person." The PAOT total also assumes that four tour buses (each averaging 30 passengers) will enter the monument each day. Campground sites are calculated for two vehicles and eight people maximum per each site.

The theoretical daily capacity of persons was derived by totaling the PAOT and multiplying that by a turnover rate of five (based on a 10-hour use day with a 2-hour average length of stay). Backcountry sites, the East Rendija campground, and tour buses have a multiplier of 1. Site-specific turnover rates were not used to calculate daily capacity because in several cases the length of stay is only 10 or 15 minutes or visitors do not stop at all; thus, the results would be grossly inflated and of little value.

Further expansion of roads, parking, and other facilities will occur only if it is determined through a visitor impact management analysis that the new facilities are inadequate and additional visitor facilities can be accommodated without causing unacceptable deterioration of natural and cultural resources or visitor experiences.

## Special Populations

The lobby, auditorium, exhibit area, and restrooms associated with the multiagency center and the Bandera visitor center will be wheelchair accessible. Where possible, select exhibits and programs at these two centers will accommodate the sensory and mentally handicapped. These two centers will also provide information on the location of facilities throughout the monument/conservation area that are designed for the handicapped. The design for these two visitor centers will incorporate signing, curb cuts, parking space striping, ramps, and other appropriate accessibility considerations. Wheelchair-accessible trails will be provided to the

TABLE 1: PARKING CAPACITY ALONG ROAD CORRIDORS - PREFERRED ALTERNATIVE

SITES SERVING FRONTCOUNTRY*	VEHICLE SPACES	THEORETICAL MAX. PAOT	THEORETICAL DAILY CAPACITY
Multiagency center	47	132	
Bandera visitor center	37	104	
Trading post	37	104	
Dripping Lava Cave	15	42	
Cerro Bandera	6	17	
East Rendija trailheads	15	42	
El Calderon	15	42	
Zuni-Acoma (west)	15	42	
Acoma-Zuni (east, if feasible)	6	17	
Sandstone Bluffs	27	76	
Las Ventanas	6	17	
The Narrows	6	17	
McCartys Crater	6	17	
<b>Subtotal</b>	238	669	x5 = 3,345
East Rendija Campground"			
12 (sites) x 8.0 people	=	96	+96
<b>Subtotal</b>		765	3,441
4 tour buses" (x 30 passengers)	=	120	+ 120
<b>Subtotal</b>		885	3,561
<b>SITES SERVING BACKCOUNTRY**</b>			
Braided Cave	4	11	
Cerro Encierro	4	11	
Other entry points	4	11	
<b>Subtotal</b>		33	33
Frontcountry		885	+3,561
<b>TOTAL</b>		918	3,594

\*Average length of stay is predicted at two hours or less.

\*Average length of stay is predicted at full day.

Ice Cave, lava surface features near Bandera Crater, the Zuni-Acoma trailhead and overlook (west end), Sandstone Bluffs overlook, and a portion of the lava features at the Narrows. There will also be a wheelchair-accessible viewing platform at the Ice Cave for visitors in wheelchairs or those who are not able to use the stairway. The cumulative effect of these opportunities will provide special visitors with a quality experience at a representative portion of the monument's resources.

Any new visitor or employee facilities and any alterations to existing facilities will comply with the appropriate laws and regulations, including the Architectural Barriers Act of 1968 (42 U.S.C. 4151 et seq.) and the Rehabilitation Act of 1973 (29 U.S.C. 792 et seq. and NPS-28). The preferred alternative must also comply with NPS Management *Policies* that state, "to the greatest extent possible, commensurate with physical limitations, the handicapped should be able to enjoy the park using the same facilities as the nonhandicapped visitor. Special interpretive facilities and programs for handicapped people are encouraged where good potential for participation is indicated."

## Water Development and Use

Congress directed the Park Service to preserve the significant natural and cultural resources of the lava flow area and manage it for the benefit and enjoyment of present and future generations, which includes the resource of naturally occurring water. Operating staff and visitor facilities will require a water supply for consumptive use. To carry out this congressional mandate, the Park Service needs the legal right to the necessary water. This legal right to water will be secured through state appropriative and federal reserved water rights.

The monument is in an area that is currently involved in a general stream basin water rights adjudication (Rio San Jose Basin Adjudication, State of New Mexico v. Kerr-McGee Corp., et al., Nos. CB-83-190-CV and CB-83-220-CV). The United States has joined in this adjudication, which began prior to the establishment of the monument. The court has ordered the United States to submit its claim to water for the monument by June 1, 1989. Appropriative and reserved water rights for the monument will be claimed in this adjudication.

After securing water rights, attempts will be made to develop a ground water supply for domestic purposes. If drilling is successful, water for the Bandera visitor center, trading post area, and the NPS residential and maintenance areas will be served by a new well adjacent to the NM 53 corridor in the Bandera area. A 75,000-gallon tank immediately north of Sandstone Ridge near NM 53 and underground pipelines will store and deliver water to all four areas. If water from the proposed well proves of inadequate quality to treat on site, is of insufficient volume, or is too costly to develop, water will be hauled to the storage tank from a local supplier. Water-saving appliances will be standard throughout area. Both the well and storage tank will be screened from public road and trail corridors.

Septic treatment systems and leachfields will be used at the Bandera visitor center and residential and maintenance areas. Chemical or low-water consumption toilets will be provided at the trading post. Mound sanitary discharge systems may be required in developed areas where soils are shallow.

## Other Utilities

Because there is single-phase power in the monument on an aerial line just north of NM 53 near the Bandera Crater area and the only source of three-phase power is 12 miles west of the monument in the Ramah area, the Park Service will make every attempt to design its facilities and utilities at Bandera to use single-phase power, including power for shop and maintenance purposes and water-well pumping. Any new electrical lines within the monument that will be visible to visitors will be placed underground to the greatest extent possible.

Telephones will be provided at the principal developed areas at Bandera Crater, placing lines underground when practicable.

Radio communication will be provided for the monument using repeater stations in or outside of the monument (the sites have not yet been selected but are under study).

## Potential for Earthquake and Volcanic Damage

Because of the general management plan alternatives for the Bandera Crater area and other volcanic areas in the monument, it is important to assess the long-term stability of the terrain as a safe place for use and development. Seismically – that is, from the standpoint of earthquakes – Laughlin and West (1976, 7) state: “It should be noted that the Zuni area is one of low seismic activity.” Volcanically -that is from the standpoint of future eruptions of lava and cinder damaging property or endangering human life – it is important to realize that basaltic volcanism of the type represented in the monument almost always begins with natural warning signs that allow hours to days advance notice before actual eruptions. Humans can be evacuated in a timely manner. The Bandera visitor center, residential/maintenance area, the one-way tour road, and the historic trading post complex all occupy lower valley slopes or valley bottoms, and could be destroyed by future eruptions of cinder and lava. However, there is no way to predict exactly where such eruptions might occur in the large Bandera lava field, and there is reasonably little chance that monument developments would be directly affected. The low incidence of eruptions within the time frame of human activity (perhaps 10,000 years ago in the Bandera area) precludes a reasonable risk of capital investment being damaged. In summary, there is no significant expectation of earthquakes or volcanic activity endangering life or property at Bandera or in other parts of the monument.

## Floodplain Compliance

There is only one floodplain in the monument, in the southern portion of the existing multiagency center tract. With the proposed boundary adjustment, this floodplain will no longer be within the monument and flood hazards will not affect human life and property within the areas being proposed for development within the monument.

## VISITOR SERVICES/INTERPRETATION PLAN<sup>8</sup>

### Introduction

The rugged 114,992-acre volcanic landscape of El Malpais National Monument is well known to many people who live in the immediate region. Nationally, however, El Malpais is virtually unknown as a vacation destination. Currently, the only tourist attraction within the monument is the small, privately owned and managed “Ice Cave and Bandera Crater,” approximately 25 miles southwest of Grants on NM 53 (see Existing Conditions map). Approximately 45,000 visitors per year see these two volcanic features at Bandera. An admission fee allows visitors to walk trails to various lava flow features, including the Ice Cave and Bandera Crater. The vast remaining portion of the volcanic badlands in the monument still offers few structured opportunities for visitors.

The preferred alternative will provide visitors with reasonable access and an opportunity to experience a representative portion of the resources of this unusual volcanic landscape. Because this newly established area has had little previous use, visitor interests, the number of visitors, and visitor use patterns are difficult to predict. Although the visitor use sites selected for the preferred alternative will provide a representative experience, only those few sites specifically mentioned by the legislation or sites that provide other primary experiences will be intensively developed. Other visitor use sites will be minimally developed and provide only basic access with no major structural development.

Various types of interpretive media and programs will convey specific themes; however, the overall media concept for interpretation throughout the monument will focus on and contribute collectively to accomplish the following objectives:

To instill in visitors a love and respect for El Malpais by viewing it from the perspective of local American Indians.

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8. This document contains more visitor services proposals in greater detail than normally included in a general management plan; that is, it contains media recommendations and is therefore more on the level of an NPS interpretive prospectus.

To provide the sense that this is a special place where if one invests the time one can feel the spirit of El Malpais and find one's heart and mind at rest.

To give visitors an understanding of the complex ecological relationships and the place of humans within those relationships.

To enhance visitor understanding of the forces that created this rugged landscape, encouraging firsthand experiences at selected features.

To give visitors an understanding of the transition from the Chacoan era to present times.

To provide the information necessary to ensure visitor safety and protection of the cultural and natural resources.

The primary visitor services/interpretation actions will occur in the following areas (refer also to the General Development – Preferred Alternative map):

a new multiagency center adjacent to I-40 (as required by the legislation)

a new NPS visitor center at the Bandera Crater area (as required by the legislation) and associated paved vehicular access to Dripping Lava Cave trailhead and to the historic trading post and Ice Cave/Bandera Crater trailhead.

The supporting interpretive sites (also shown on the General Development – Preferred Alternative map) include the following (refer to the development concept plan maps in the previous section for a description of the actual development in each area):

Las Ventanas/Sandstone Bluffs

East Rendija area

Braided Cave

El Calderon area

the Zuni-Acoma Trail

the Narrows

## McCartys viewpoint

entrance/orientation kiosk along NM 117

The following discussion describes the interpretation that will complement the development/facilities/trails described in the previous "Visitor Facilities/Development" section. In other words, it is the intent of this section to describe what visitors will see, learn, and experience if the preferred alternative is implemented. It should be noted that the planning and design for all interpretive media for the monument (described in this section and in appendix F) and the conservation area will be professionally done, coordinated between the Bureau of Land Management and the Park Service, and similar in visual appearance throughout El Malpais. American Indians will be consulted regarding the development of interpretive messages that are related to them. Public education in visitor centers and through other media will carry messages to help reduce damage to cultural and natural resources, including delicate geologic features.

Parts of this section stress how the needs of local American Indian groups will be met at El Malpais. However, there is another role Indians will play in the national monument. Indians are among the visitors who will come to El Malpais to tour the visitor centers and see the features along the trails. Some will be from the local area, and others from more distant places. Interpretation of the cultural landscape through the eyes of American Indians should be interesting to everyone. It is important that this theme be interpreted well at El Malpais, in an accurate and inspiring way so that people of Indian ancestry will enjoy the resources and feel encouraged to recommend how to improve the interpretive programs.

## Multiagency Center, Grants

**Signs.** Interstate 40, a major cross-country route, parallels the northern boundary of the national monument/conservation area. I-40 actually bisects one of the northernmost lobes of the McCartys lava flow, but exposes a mere fringe of the total volcanic landscape. Few travelers realize that this small area of volcanic rock is only a sample of spectacular lava flows that extend southward for

another 35 miles. Most interstate travelers have no idea that they are passing a unique opportunity.

For many, the first contact with the national monument and conservation area will be the interstate signs (both east and west of Grants) identifying the exit for the multiagency center. These interstate signs will most likely identify El Malpais National Monument/National Conservation Area and contain the name of the multiagency center. Because the terms El Malpais and badlands have no direct correlation to volcanism, it is necessary that either the name of the multiagency center and/or additional descriptive phrases be used on these interstate signs to convey the true identity of this resource – a volcanic landscape.

### **Interpretation - What Visitors Will See and Learn at the Multiagency Center.**<sup>9</sup>

Details about interpretation at the multiagency center, such as exhibits, audiovisual (AV) media, etc., are in appendix F; however, an overview of interpretive objectives of the facility is provided below. The functions and size of the multiagency center (described in the “Visitor Facilities/Development Plan” section and in appendix F) will not be repeated here.

The new multiagency center for El Malpais will serve dual purposes. It will be a travelers’ information/orientation center, providing visitors with information on areas of interest in the region. Such information will encompass El Malpais National Monument/National Conservation Area and western New Mexico (areas within an **easy** drive of the Grants/Milan area). The other purpose will be dissemination of Masau Trail information to interstate highway travelers. (As described previously, the Masau Trail is a vehicular tour route along existing roads that links prehistoric and historic cultural sites in New Mexico and eastern Arizona.) The multiagency center and its interpretive media will serve as the central point for the Masau Trail, an integrative approach to interpreting and awakening visitors to the prehistory and history of part of the Southwest. The center will not be a “destination” interpretive facility; rather it

will provide “stage-setting” interpretation and information and entice visitors to go see the outstanding resources of El Malpais, the region, and the Masau Trail for themselves.

The key to fitting this large and diverse amount of information into a single visitor service facility is brevity – exhibits will be limited to primary themes. Some of the exhibits will be designed to arouse interest and motivate travelers to visit El Malpais National Monument/National Conservation Area and other nearby U.S. Forest Service, state, and American Indian sites. Other exhibits will pertain to the Masau Trail, giving travelers an idea of what to see along the trail and where the areas are in relation to the center. These exhibits will not tell the visitor so much about any of the areas that they will not want to see them firsthand.

The exhibit area in the visitor center will deal with two generic but interrelated themes – the changing landscapes and environments of the region and the human record of occupation from the prehistoric Anasazi cultures to the contemporary American Indians. Concentrating on these broad themes will convey a central interpretive message about the cultural landscape that is highly relevant to the resources of El Malpais and the local region as well as those of the Masau Trail.

Between the reception area and the trip planning/exhibit areas there will be large topographic relief models or graphics that depict the El Malpais lava fields (designed to show geological components) and the larger region (designed to orient visitors and interest them in traveling to the various sites depicted).

There will be exhibits about the land – for example rock samples that help visitors identify the various types of features associated with the landscape, coupled with an AV unit or photographs that place the samples in context with the environments they came from. There will be other exhibits (artifacts, photographs, and graphic materials) about people associated with the land. These exhibits will help visitors learn about the American Indian cultures

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9. The following discussion of the center is based in part on the results of interagency workgroups that were held in New Mexico during October and December of 1988 (summaries of these workgroups are in appendix G) and also on meetings with representatives of the National Park Service, Bureau of Land Management, and the Acoma, Ramah Navajo, and Zuni Indian tribes.

that have occupied the area for more than 1,000 years and provide a reference to events that were happening in other parts of the world during the same time. One exhibit will show current Indian reservation boundaries compared with earlier territories. An alcove in the exhibit area will present another video program that deals with the relationships, feelings, and understandings of the different peoples for this land -this special place, El Malpais. This video will be very specific to the El Malpais area and will perhaps identify some of the features of the landscape while presenting a number of different speakers -for example members of the Acoma, Laguna, Ramah, and Zuni tribes, and representatives of the Park Service and the Bureau of Land Management – discussing what they see, feel, and value about the land. The objective of this video will not be to teach the differing philosophies or beliefs of the different peoples (an objective at the **Bandera** visitor center – described below); rather the objective at the multiagency center will be to point out that there are differences and that we should respect others' viewpoints as well as the land and shared resources. This video will interest visitors in seeing and learning more about this special place and the people who love and respect it.

A 15- to 20-minute interpretive film about the Masau Trail will be produced for showing in the AV theater. The film will emphasize the traditions of the Puebloan culture, including its contemporary descendants and prehistoric Pueblo cultures that are geographically within the Masau Trail region.

## **Bandera Crater Area**

**Bandera Visitor Center.** The **Bandera** visitor center will be the primary interpretive facility for the national monument. This center also has an important cross-cultural and trans-time story to relate. More details about interpretation at the center, such as exhibits, wayside exhibits, AV media, are in appendix F; however, an overview of interpretive objectives of the facility is provided below. The functions and size of the center,

described in the previous “Visitor Facilities/ Development Plan” section and in appendix F, will not be repeated here.

The AV presentation will be the focus of interpretation at the visitor center, its purpose being to convey the message that El Malpais is a special place and why and to present the relationship between American Indians and the land. The rugged landscape will be portrayed as a cultural landscape” where the land and culture are related. The messages will instill in the visitor a feeling for the landscape and the American Indian people who occupy and still rely on it. The AV will provide a window into the world view of other cultures and, if successful, will build respect for each other and encourage everyone to recognize land values in a different light.

There will be an exhibit area that complements the AV presentation by highlighting specific aspects of the cultural landscape. Some exhibits will emphasize the evolution and sequence of landforms – both the lava flows and the sandstone formations. Another exhibit will present some of the unusual ecological adaptations of the flora and fauna, including the bats, kipukas, inverted life zones, faunal and floral diversity, and dwarf forests. Another exhibit will highlight past and present cultures that have had contact with or been influenced by El Malpais' landscape, including the post-Chacoan culture, various European cultures, and contemporary American Indian cultures that have direct ties to El Malpais.

Once visitors leave the **Bandera** visitor center, many will choose to visit the Ice Cave and **Bandera** Crater. These two features have long been recognized as primary tourist attractions. Visitors will reach these two features along a one-way park road (designed for low speed) that reveals the aesthetic qualities of the landscape through which it passes. For many this road will provide an opportunity to slow down and leave the rush of civilization behind and will serve to heighten anticipation for the experiences to come.

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10. A cultural landscape is a geographic area containing both cultural and natural resources characterized by use by contemporary peoples, including subsistence hunting and gathering, religious or sacred ceremonies, and other traditional uses. See the cultural landscape discussion in “The Plan for Cultural Resources Management” section of this document.

**Dripping Lava Cave/Lava Crater.** The trading post, the Ice Cave, and Bandera Crater will be the primary destinations for most visitors; however, visitors who choose can make one stop before reaching these features. A spur road, parking area, and trailhead will provide access to Dripping Lava Cave and Lava Crater. An orientation/safety wayside at the trailhead will ensure that visitors are prepared for the experience. A short .3-mile trail will lead to the entrance of Dripping Lava Cave. A wayside exhibit at the mouth of the cave will describe how this 2,000-foot-long lava tube cave was formed and help visitors anticipate a few of the features found inside. Catwalk-like steps will provide safe access to the cave floor, and a well-engineered trail will provide access along the length of this enormous underground chamber. For visitors who plan to stay at El Malpais only a short time, this may be their only opportunity to see what it is like in a world of subterranean darkness. Dripping lava formations, ice-water lakes, an immense overhead dome, and other flow formations will all contribute to this unusual cave experience. Electric lighting will be provided or visitors will be provided with lanterns or flashlights for their visit into the cave.

Another segment of the surface trail will lead to Lava Crater. The trail to the crater rim will be routed to take advantage of views. A wayside exhibit, if appropriate at the trailhead, will contrast this crater to the other types of craters found in El Malpais, describe how they were formed, and present any significant themes or symbolism associated with these types of landforms.

**Historic Trading Post Complex.** The existing historic trading post complex will be adaptively used as a staging area and trailhead for Bandera Crater, the Ice Cave, and the lava surface features trail (described below). The trading post building, other structures that contribute to its historic significance, and selected artifacts will be retained to maintain a historic scene reminiscent of early pioneering efforts in tourism. (The Park Service may acquire selected cultural artifacts currently on display at the trading post. These objects may be used for display here or in exhibits at the multiagency center or Bandera visitor center.) One of the cabins will be stabilized, fitted with period furnishings (using existing furnishings to the extent possible), and interpreted as an example of an early-day tourist cabin. A wayside exhibit will be used to interpret the historic scene and highlight themes associated with

the site, allowing today's visitors to contrast themselves with tourists of yesteryear. Any new development, such as wheelchair-accessible trails, will avoid intruding on the historic scene and blend architecturally with the rustic surroundings. A new 37-car parking area and picnic tables will be provided just east of the trading post.

A portion of the trading post building, designed to function with or without staff, will provide orientation and information to help visitors select trails. A map or graphic exhibit will show the trails and identify lengths, difficulty, time requirements, special features associated with each trail, and any necessary safety information. A small cooperating association sales space (separate and securable when staff are not available) will provide visitors who did not stop at the visitor center a chance to obtain interpretive publications. Interpretive pamphlets and other materials will be distributed.

The remaining portion of the trading post will provide meeting space for special groups on a reservation basis. This space will be set up as a nature center workshop room. For example, school groups will use this space for pre-trip orientation and interpretive presentations.

**Ice Cave/Lava Surface Features Trail.** Two modern trails (both wheelchair accessible) will start from the trading post – one to the Ice Cave and the other to the lava surface features that are near the beginning of the trail to Bandera Crater (refer to the Bandera Crater Area DCP for orientation to the trails described below). A new stairway will be built for entry to the Ice Cave, and a special platform will allow wheelchair visitors and others who are unable to manage stairs to see the ice. A wayside exhibit will highlight the process that formed this cave and its ice features and explain how the ice maintains itself through the summer; the exhibits will also explain the significance of ice caves to humans, focusing both on prehistorical and historical uses of this important source of water.

A short .5-mile lava surface features trail (wheelchair accessible) will offer visitors a special experience in lava terrain. This trail will include aa and pahoehoe lava, a spattercone, lava cast tree molds, and a cinder landscape. A wayside exhibit will describe the formation and significance of these volcanic features.

**Bandera Crater Trail.** The Bandera Crater trail (part of the old motor route) will continue beyond the lava surface features trail and lead to Bandera Crater. There will also be a connector trail (also part of the old motor tour route) to Bandera Crater that will originate from near the Ice Cave. A wayside exhibit for the crater will show visitors how violent explosions and eruptions created this crater and adjacent lava canyon. One wayside exhibit will focus on the breached south wall of the crater and the upper visible portion of the 16-mile lava tube system that starts at the crater. Another wayside exhibit at a new inner crater overlook platform will dramatize the view of the interior of the monument's best-known cinder crater. Unlike most craters in the area, the inner portion of Bandera Crater is much deeper (200 feet) than the terrain around its base.

A wayside exhibit will also be used to interpret selected features along the two trails to Bandera Crater. Blocky lava, pahoehoe plates, picturesque trees in twisted and contorted shapes, collapse features, and prehistoric circular rock walls are just a few of the features that will be interpreted. Two short spur trails, with wayside exhibits, may also be constructed depending on the environmental suitability of the sites. One trail would lead to Coffin Tube (a surface lava tube with an unusual rectangular profile) and another to Lichen Sink (a 75-foot deep collapse structure with an ice-water spring and colorful mosses, lichens, and algae growing at the entrance). If visitor access to Coffin Tube and Lichen Sink is determined environmentally suitable, these features may alternatively be included as part of ranger-guided walks in the Bandera area.

**Spattercone Valley Trail.** This 1.3-mile trail, which is rich in volcanic features, will begin from the Ice Cave trail a short distance from the trading post. An orientation/safety wayside exhibit with a self-guiding interpretive publication covering the Spattercone Valley trail and the connector trail to Cerro Bandera (described below) will be provided at trailheads and at the trading post to ensure that visitors are prepared for the experience. Visitors should be aware that walking is difficult on this tortuous up-and-down volcanic terrain. The Spattercone Valley trail will cross one of the more jagged lava flows in El Malpais, and visitors should feel secure about where they are on the trail. The visitor experience will be like walking on the moon or being lost in a sea of lava. Spattercone Valley will be the primary

destination, where visitors will see several large spattercones, including the 40-foot-high Exquisite Cone. Although the self-guiding publication will answer a few of the obvious questions about how these features were formed, it will also convey a broader ecological message of how plants, animals, and humans have adapted to this most unusual landscape. Features that may be considered for interpretation include Hidden, Lava Bubble, and Picture Window sinks; Indian Water collapse and ice cave; and Perfect Circle, Little Rattler, and Hanging Fern collapses.

From Exquisite Cone, visitors will return on the same trail or continue on to the intersection of the Sandstone Ridge connector trail. From there visitors can take a .8-mile trail to Sandstone Ridge or go back to the trading post on the 1.1-mile Spattercone Valley connector trail that parallels the tour road.

**Cerro Bandera Connector Trail.** This 1.1-mile trail will connect the Ice Cave with the trailhead to the Cerro Bandera summit trail. An orientation/safety wayside with a self-guiding interpretive trail publication will be provided at the beginning of the trail to ensure that visitors are prepared for the experience. The publication (which also covers the Spattercone Valley trail) will interpret the surface lava tubes along the connector trail to Cerro Bandera, as well as other cultural and natural features. (Vehicular access to the parking area and trailhead and the trail to Cerro Bandera summit are described below under the East Rendija area.)

## East Rendija Area

A gravel road will provide vehicular access from NM 53 to the East Rendija area trailhead (see East Rendija Area DCP). Prior to reaching the East Rendija trailhead, access to the Cerro Bandera trailhead will be provided by way of a short spur road. The steep 1-mile Cerro Bandera trail will take visitors to the highest point in the national monument. From this commanding view, visitors can see hundreds of square miles of the El Malpais region, including the Zuni Uplift, Mt. Taylor, the breached cone and massive flow from Bandera Crater, the historic trading post complex, Sandstone Bluffs, McCartys Valley, Cerro Rendija, the Chain of Craters cinder cones, the Sawtooth Mountains, Cebollita Mesa, and the sandstone cliffs near Ramah. Wayside exhibit panels will be used

only at the summit. One exhibit will present a geologic perspective by identifying the most prominent geographic features and placing them in context with the regional volcanic story. Another exhibit will use the “world view” of other cultures to portray the same geographic features in the context of symbolism or legend (in consultation with local Indian groups).

The Cerro Bandera parking area/trailhead may also be a stop along the Continental Divide National Recreation Trail,” with access to the Chain of Craters and other points south in the national conservation area.

Visitors on the new road will also be encouraged to stop at the roadside pulloff at the lava wall trailhead before reaching East Rendija. An orientation/safety wayside will prepare visitors for the experience. A short loop trail will begin at the parking lot and skirt the edge of this impressive 70-foot wall of lava. A self-guiding interpretive trail publication for the East Rendija area, including the lava wall, will be available at the trailhead and include some of the basic information about the flow’s origin, age, boundaries, composition, and dimensions. The contrast of vegetation on and adjacent to the lava will also be discussed.

The East Rendija trailhead will be the final stop for visitors on the new road. An orientation/safety wayside and a self-guiding interpretive publication at the trailhead will ensure that visitors are prepared for the experience. The publication will interpret cultural and natural features along the trail, but will focus on two of the monument’s most spectacular lava tubes – Four-Window and Big Skylight caves.

Inside Four-Window Cave visitors will see the darkness being penetrated by light from above. This cave is over 900 feet long and has about a **50-foot** ceiling with four skylights. The first portion of the cave trail will cross a rugged lava floor surrounded by jagged lava walls. In contrast, the middle portion has smooth walls and flat floors that twist and wind like a subway tunnel for 400 feet. The view back to the mouth of the cave and to the skylights is unforgettable. Visitors can look through these four openings for a dramatic view of the sky, clouds, and overhanging trees. An equally

spectacular encounter of the stacked tube system lies ahead for those who care to venture even farther into this cave. The publication for East Rendija will interpret these interesting features, but for many the cave may be more of an inspirational experience. Imagination and interpretation may combine to make visitors wonder how other cultures may have viewed these natural phenomena.

Big Skylight Cave, which will also be entered by a trail, has a 30-foot circular skylight that allows an impressive view from below or from the trail above. This cave also has “bathtub” rings on the cave walls, which are associated with the falling levels of lava that flowed down the tube.

The trail to Four-Window and Big Skylight caves will offer various cultural and natural features to arouse the visitor’s interest. The self-guiding publication for East Rendija will also identify Caterpillar Collapse (a large winding collapse feature overwhelmed by streams of aa lava) and Seven Bridges (a long lava tube collapse where narrow spans of the former ceilings remain, forming seven natural bridges across the collapsed zone). Various types of prehistoric structures may be interpreted (with input from American Indians) to show the relationship between this lava terrain and the native people, both past and present.

### **Braided Cave**

The existing high-clearance primitive road will continue south from East Rendija to Braided Cave. A small dirt parking area, trailhead, and .4-mile primitive trail will provide the more adventuresome an opportunity to hike to one of the longer tubes in the monument. The crisscrossing system of rejoining tubes provides many opportunities for visitors to explore and discover for themselves. A self-guiding publication for East Rendija will also interpret the Braided Cave area, emphasizing those flows and features – such as the deposits of black sand within the tubes that are prominent in the Braided Cave area.

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11. The alignment of this trail has not yet been decided; it may also follow other trail alignments in the Bandera area.

## **El Calderon Area**

From a new parking area and trailhead along the improved access road in the area, a trail will lead to the entrance of Junction Cave. An orientation/safety wayside at the trailhead will prepare visitors for the cave experience, but visitors will be on their own to explore and discover. Junction Cave may receive a lot of use during the winter months when snow restricts access to Dripping Lava Cave and East Rendija.

Bat Cave will command most of the attention in the El Calderon area during summer months. Evening bat flights will continue to attract local residents and expected increases in regional and national visitors. A new .3-mile trail starting at a final new parking area will lead to a small informal viewing area set back from the mouth of the cave. An orientation/safety wayside at the trailhead will prepare visitors for the experience. Because the bat flights start at dusk, a well-defined trail will be required to ensure visitors a safe return to their cars. NPS regulations will prohibit entry into Bat Cave, and the layout and design of the trail and viewing area will also discourage cave entry. A wayside exhibit near the viewing area will use photography and/or artwork to give visitors a close-up image of these small creatures. The numbers of bats, what they do, where they go, and the role these lava caves play in their life cycle are questions that will be answered.

Explanations of the visitor health issues and possible damage to the bat population will also be provided to discourage visitors from entering the Bat Cave.

El Calderon is a dominant volcanic peak that is visible from the Bat Cave trail. A wayside exhibit will be used to interpret this cinder cone and its associated collapsed and intact tubes that wind for miles. El Caldron will also be identified as the source of older flows in this portion of the monument.

A second short trail, also starting at the new Bat Cave parking area, will lead visitors to Double Sinks. Visitors who use this trail may be surprised when two large circular holes (one about 30 feet across and one about 90 feet across, both 60 feet deep) appear unexpectedly in the earth's surface. These two collapse structures will provide startling evidence that molten lava once flowed here. A

wayside exhibit will be used to explain these two features and their microclimates. Lush ferns and mosses decorate the bottom of these two cavities. The abundance of such microclimates in this lava environment has created habitats for some of the 75 species of mosses and lichen that have been identified in the monument. The short trail between Double Sinks and Junction Cave will be a link between all three features and provide visitors with choices for short or longer hikes in the area.

## **Zuni-Acoma/Acoma-Zuni Trail**

The existing gravel entrance road will provide access to the west end of the trail from NM 53. The existing trail to a nearby trailhead overlook will be surfaced for wheelchair access. An orientation/safety wayside exhibit will be placed at the trailhead overlook. At the overlook visitors will visualize the general easterly direction of the trail across the flows. Another wayside will interpret the prehistoric rock structures near the overlook that served as bridges to span a small chasm.

A wayside exhibit will show how this trail relates to other early trails in the region, highlighting that portion of the trail that crosses El Malpais. Visitors should know something about the prehistoric and historic travelers who crossed this rugged badlands. Part of the wayside exhibit will touch on western expansion and the various expeditions that crossed or bypassed El Malpais in search of a better route west, including the **Dominquez-Escalante** expedition. A self-guiding publication for the Zuni-Acoma trail will provide a brief, general history of the trail. The publication will weave both the natural and cultural features found along the trail into a story of use that spans at least 1,000 years.

If an easement is acquired for the east end of the trail, a roadside pullout, small parking area, and trailhead will be provided adjacent to NM 117. A wayside exhibit and the same self-guiding publication just described will provide information for the east end of the trail.

## **Las Ventanas**

A 1.7-mile paved road from NM 117 will provide access to Sandstone Bluffs overlook. Once on this road, visitors will be able to take a short spur road

to the Las Ventanas trailhead/parking area. A wayside exhibit at the new trailhead/parking area will explain the importance of the entire prehistoric Chacoan culture system. A 1.3-mile trail will lead from the trailhead to a viewpoint on the ridge that looks down on a large natural sandstone arch and continues to the Las Ventanas Chacoan site. Spectacular views from this trail will generate numerous questions, some of which will be answered at the arch viewpoint through a wayside exhibit. More importantly, this view is inspiring and suggests the significance this landscape plays in the lives of American Indians, both past and present.

The trail will continue to Las Ventanas where visitors will see the physical remains of a community that thrived sometime between A.D. 1050 and 1200. The preferred alternative includes the option of removing the backfill from previous archeological excavation and stabilizing the exposed circular outline of the tower kiva for viewing by visitors. A wayside exhibit will identify Las Ventanas as a Chacoan outlier, placing it in context with both Chaco Canyon and the other Chaco outliers (more than 70) in the region (American Indian consultation will be sought for the wayside exhibit). The functions served by these visible structures (roomblocks and the tower kiva and great kiva) will be interpreted using artwork to create a picture of everyday life in this community.

### **Sandstone Bluffs Overlook**

The next stop for most visitors will be Sandstone Bluffs overlook. There will be parking and a short wheelchair-accessible trail to a viewpoint near the rim so visitors can see the landscape and lava from horizon to horizon. This trail and viewpoint will be designed to enhance and not detract from the overlook experience.

This overlook provides the best panorama of El Malpais, reveals near and distant patterns of an immense lava field, and provides opportunities to interpret a long continuum of human occupancy. Wayside exhibit panels will interpret the McCartys flow as a wide, 35-mile-long stretch of lava that is generally unweathered, uneroded, and barren. One exhibit will identify a few of the more prominent features – such as massive plates of pahoehoe lava turned on end, large pressure ridges, the small crater that was the source of the lava flow, the

Chain of Craters, and the Zuni Mountains – presenting a few facts about each. With consultation with the American Indians, an adjacent wayside will contrast this more scientific presentation with an alternative view of how other cultures perceive the creation of this landscape.

### **The Narrows**

From the roadside pullout and trailhead along NM 117 a .4-mile loop trail will provide the only opportunity along the NM 117 corridor for visitors to experience the spectacular features of the McCartys lava flow firsthand. The first short section of the trail will be wheelchair accessible. An orientation/safety wayside and a self-guiding interpretive publication will be provided at the trailhead to prepare visitors for this short hike onto the lava.

This visitor experience will be like standing in a vast field of freshly cooled lava. Large chunks of pahoehoe lava are chaotically pushed into each other along pressure ridges and in lava sinks. Looking back, visitors will see the dark lava against the light sandstone walls that contained this flow. A self-guiding trail publication will interpret the natural features, including lava squeeze-ups, pressure ridges, pahoehoe lava of different textures, dwarf vegetation, and an unusual stand of aspen.

### **McCartys Crater Viewpoint**

**Option 1.** If this option is chosen, a short paved spur road from NM 117 and small parking area will be constructed to a new trailhead. A .3-mile trail will lead to an interpretive overlook of the McCartys flow. From this point visitors will be able to look out across a great expanse of lava – the McCartys flow. The tiny crater that was the source of this massive lava flow is more visible here than at any other proposed development in the monument/conservation area. A wayside exhibit panel will interpret the flow from a geological perspective and then contrast it with Indian creation stories (to be interpreted in consultation with the American Indians). Another panel will interpret use of the crater as a bombing range. Visitors will also be interested in the geographic features that surround the lava-filled McCartys Valley. The orientation wayside near NM 117 will inform northbound visitors of the features ahead.

**Option 2.** There will be no development at McCartys viewpoint.

### **Roadside Kiosk Along NM 117**

If option 2 is selected for McCartys Crater viewpoint, a pullout, small parking area, and orientation kiosk will be constructed on NM 117 near the south monument/conservation area boundary. A wayside exhibit will be incorporated into the design to provide orientation, information, and a map with major points of interest. The wayside exhibit will also highlight the resources.

### **Visitor Use Monitoring**

There is very little specific information about visitor use of the monument. These data are important for efficient and effective management. To determine levels and patterns of visitor use throughout the monument, the Park Service will establish a monitoring system that will provide accurate collection of visitor use data at all developed visitor facilities and will allow for the timely evaluation and reporting of use statistics. In addition, a parallel monitoring system will be devised to estimate levels and patterns of backcountry use. These monitoring systems will be implemented as soon as possible and will be expanded and adapted as necessary.

### **Recreational Activities**

The Bandera visitor center, the scenic overlook pulloffs, and the cultural and natural feature pulloffs along NM 117 and NM 53 are included in the frontcountry. The Bandera Crater area will be the primary destination for most monument visitors. The multiagency center, the Bandera visitor center, and the trails to the Ice Cave, Bandera Crater, and Dripping Lava Cave will dominate the visitor experience for those who stay four hours or less.

First-time or repeat visitors who plan to spend one or more full days in the monument will travel more widely and visit more sites. In addition to the multiagency center and the Bandera visitor center, the East Rendija area, Sandstone Bluffs overlook, and the Las Ventanas Chacoan site will most likely attract visitors who choose to stay longer than half a day.

Recreational activities will include sight-seeing (vehicular touring), interpretive activities, hiking, spelunking, bird-watching, backpacking, backcountry camping, vehicular camping, and four-wheel driving. Specific backcountry hiking and backpacking opportunities will be specified in a future backcountry management plan. A brief description of the expected visitor experience relative to the standard of access and interpretation in each subzone is in the earlier section on management zoning.

**Backcountry, Nonmotorized Recreation.** A small number of visitors (less than 5 percent) will use the primitive subzone (approximately 109,275 acres), where they can hike cross-country or on primitive trails. Caving will occur on a permit-controlled basis. There will be no facilities and no on-site interpretation, and the emphasis will be on learning independently. Encounters with others will be infrequent or nonexistent, giving visitors the perception of a high degree of self-reliance and the greatest opportunity for solitude.

**Backcountry, Motorized Recreation.** A small number of visitors will use high-clearance or four-wheel drive vehicles along specified corridors in the semi-primitive subzone (approximately 3,988 acres) where they can access more remote areas within the monument/conservation area. There will be no facilities and little on-site interpretation. A low frequency of encounters with others will give visitors the perception of self-reliance and opportunities for solitude. Access to Braided Cave (in the monument) and Cerro Encierro and Cerritos de Jaspe (in the conservation area) fall within this category.

**Frontcountry Sight-seeing.** Most visitors will exclusively use the monument development zone (including the developed and rustic subzones and containing approximately 1,260 acres), where they can easily and quickly reach many of the monument's outstanding features by way of paved and gravel roads. Use will be encouraged by facilities such as visitor centers, scenic overlooks, a campground, restrooms and vault toilets, picnic tables, and a variety of interpretive stops and trails. Films, exhibits, demonstrations, and interpretive publications will be available at the two visitor centers. There will be on-site exhibits and publications at the major natural and cultural features, and guided interpretive activities will be offered. There will be a moderate to high frequency

of encounters with other visitors in the frontcountry. Despite the frequency of encounters, some of the trails may provide opportunities for solitude. The high levels of development and interpretive services will require a relatively low level of self-reliance.

## THE PLAN FOR CULTURAL RESOURCES MANAGEMENT

### Introduction

It is the Park Service's responsibility to locate and evaluate the significance of the natural and cultural resources in the monument and to provide resource-sensitive management, scientific study, preservation, and interpretation. El Malpais is a new unit of the national park system that contains numerous and complex cultural resources. Because it is a new area, there are major deficiencies in resource inventories, research data, and interpretive information as well as specific directions to deal with numerous other important problems. The Park Service must find ways to keep these resources unimpaired for future generations and provide for American Indian traditional use while managing the resources for the enjoyment of all visitors.

The following plan identifies the major cultural resource issues at El Malpais and recommends future studies and research.<sup>12</sup> It is designed to provide managers and cultural resource specialists with long-term, general guidance and a framework from which to make decisions regarding these resources. Guidelines need to allow El Malpais managers discretion in reaching decisions that reflect American Indian preferences while remaining in accord with the law; therefore, only general actions are proposed in this plan. Because of the lack of data, this plan is interim in nature.

Consistent with NPS procedure, a detailed resources management plan (RMP) will be written in the future. Because the cultural and natural resources at El Malpais are inseparable, these resources will be integrated in this detailed RMP.

The RMP will be based on expanded resource knowledge and increased experience with the resources. Specific project statements for the monument's RMP can be abstracted directly from the present document. The future RMP will also prioritize necessary projects and management actions so they can be accomplished in an orderly sequence. The RMP will further define the issues, describe ongoing operations and special projects, state costs and personnel needs, and describe the alternatives and their impacts.

### An Overview of This Plan

The cultural resources in El Malpais are of two types, which need to be managed in different ways. The first of these, the prehistoric and historic resources, are nonrenewable. The Park Service has a long history of dealing with these resources and has developed guidelines and policies for their management (which are described later in this plan and in appendix H). According to these guidelines and policies, the Park Service must prescribe specifically how the prehistoric and historic resources are to be managed at El Malpais.

The second type of resource is related to traditional human use. The establishing legislation for El Malpais specifically ensures that Indian peoples have nonexclusive access to monument and conservation area lands for traditional cultural and religious purposes. American Indians whose lands surround El Malpais have a long and deeply felt attachment to this special area. The lava flows and the hills and mountains are part of their creation stories and world view, and American Indian religious and subsistence activities are inseparable from this harsh and beautiful landscape. The significance of this cultural landscape<sup>13</sup> comes from past and present human interaction with and use of the total natural environment. However, these concepts are less familiar to NPS personnel, and there are few guidelines for management. Sensitivity is called for in the ways the Park Service manages the cultural landscape and affects the lives and practices of American Indians.

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12. A cultural resources management plan often includes a discussion of the environmental resources setting; in this document, this information is in the "Affected Environment" section.

13. A more thorough discussion of a cultural landscape appears later in this plan.

The Park Service will consult with local Indian peoples to develop mutually acceptable ways to enhance their privacy during religious activities, facilitate their gathering and other subsistence activities, and build a sense of shared responsibility for protection of religious and archeological sites. Ownership of land in legal title by the federal government does not mean that El Malpais does not also belong to Indians in a special “usership” and religious sense. It is inferred in the establishing legislation, and other laws make it clear, that local American Indians are also guardians of El Malpais. Effective consultation between American Indians and NPS staff leading to improved trust is crucial to the future of the national monument and is a basic part of this plan.

### **The Foundation of the Plan – Laws, Guidelines, and Policies**

A number of laws, guidelines, and policies were considered during planning. NPS-28, the “Cultural Resources Management Guidelines” (hereafter referred to as NPS-28), provides basic direction for dealing with cultural resources. The laws and policies seek a balance between the needs of American Indians to use areas of the national park system for traditional activities and management of the resources held in trust for all Americans by the National Park Service. Summaries of the most important cultural resources laws, regulations, proclamations, orders, standards, guidelines, and policies applicable to El Malpais are included as appendix H.

### **The Cultural Landscape at El Malpais**

El Malpais National Monument may be described as a cultural landscape (specifically, it may be an ethnographic cultural landscape<sup>14</sup>) -that is, a geographic area containing both cultural and natural resources that is characterized by use by contemporary peoples, including religious ceremonies, subsistence hunting and gathering, and other traditional activities. (Because criteria that help define a cultural landscape are linked to

National Register of Historic Places determinations, El Malpais is actually considered a potential cultural landscape until the area(s) are accepted as national register properties.) The inventory and evaluation of the El Malpais landscape (preceding national register nomination) will confirm the type or types of cultural landscapes that exist in the national monument.

### **American Indian Perceptions and Use of the Cultural Landscape.**

Usually, the most conspicuous elements of a cultural landscape are the human-built and natural environments. At El Malpais, however, one of the most important elements is the special meaning that American Indians ascribe to the landforms, lava flows, plants, and animals. These features are valued by the American Indians as a type of reference point in their religious beliefs and form an inextricable part of their world view, permeating all facets of their culture. The special environment of El Malpais influences human perceptions as well as use of the land and its resources. For example, particular lava features play an important role in American Indian worship. Special plants may grow only in certain places in El Malpais. To take advantage of these scattered resources, American Indians have had to learn the locations and times of year each species should be harvested; they also know the necessary rituals for each place and resource. This special knowledge, evolving over centuries of experience, has been passed from generation to generation. Traditional cultures have a long and enduring relationship with the land and its resources, a relationship that contributes to their sense of place and links the prehistoric past with the ethnographic present.

Contemporary American Indian legends and stories describing the creation of El Malpais make it obvious that the landscape continues to be part of the cultural identity of these peoples. The El Malpais landscape clearly reflects this identity and can come alive to almost anyone who begins to see “it is the human caring about a place that determines its vitality” (NPS Gilbert 1985b, i).

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14. There are five kinds of cultural landscapes (not mutually exclusive) – historic scene, historic site, historic designed landscape, historic vernacular landscape, and ethnographic landscape. Definitions can be found in NPS-28, appendix A.

Other groups, such as the Hispanics and ranchers, should not be overlooked in portraying the cultural landscape at El Malpais. Their perceptions reflect culturally diverse views, values, and resource uses that are important to the definition of the cultural landscape.

**Changes in the Cultural Landscape.** Natural forces continue to shape the landscape, yet El Malpais has retained its essential qualities of immense space, open vistas, and stark contrasts – especially the contrast of black lava rock spreading out below colorful sandstone cliffs and cinder craters.

The landscape has also been altered by humans through occupation and use of the environment. However, other than the roadways skirting the lava flows around the monument's boundaries, few man-made features are obvious to the casual observer. Close examination reveals trails through the lava that link special places for American Indians. Colorful pot sherds and fragments of chipped stone in quiet recesses mark thousands of years of history. Weathered cabins and sagging barbed-wire fences of the historic era also link the land to its past, continuing the human story at El Malpais.

**How the Cultural Landscape Will Be Delineated.** A future study for El Malpais will specifically define its cultural landscape. This will require the skill and insight of a number of specialists such as park managers, landscape architects, ecologists, historical architects, archeologists, cultural anthropologists and geographers, and representatives of the several cultures to whom El Malpais is important.

Research into the unknowns about this cultural landscape will result in information that is useful to managers. Historical and ethnographic research will first determine who used and still uses the landscape, how it was used, and what the landmarks and boundaries of the landscape may be. This study will help relate visible features and cultural traditions in time and space. In part, ethnographic data collection and research in the monument will be guided by and a component of the cultural landscape study. Archeological investigations will further define boundaries describe resources, and help refine the historic and prehistoric themes and contexts associated with El Malpais' cultural landscape.

Identification of human use patterns and architectural design (including the vernacular) will be a part of the process. The presence and impacts of monument visitors will also be considered. The identification of natural features will be especially important, because the landforms and distribution of water, vegetation, and animals heavily influence human use. Data on the natural and cultural features will help in understanding the condition of all the resources and help delineate the landscape. The cultural landscape study will also evaluate the landscape and its resources for national register purposes, and nomination(s) will be prepared as applicable. In this study, none of the types of resources –cultural, ethnographic, or natural – should assume primacy; instead, the study will be a holistic, synergistic product.

In recognition of the significance of this cultural landscape to contemporary American Indian groups, and to heighten awareness among other monument users, Indian names will also be used to identify landmarks wherever appropriate. Naming will be part of a cooperative effort with American Indians so that approved common tribal names are used for these features; special consideration may be needed for features named by more than one tribe.

Guided by the cultural landscape study, managers may prescribe additional actions, including scientific research, stabilization and/or preservation of significant resources, specific protection strategies, and interpretation. The landscape study should have high priority for completion to guide management decisions, especially those related to development and concerns of the Indians.

### **Protecting American Indian Religious Freedom**

The American Indian Religious Freedom Act provides for the preservation of Indian rights to practice their traditional beliefs; it also provides for consultation with Indian groups in planning and management activities that affect them. To fully comply with this act, the basic tenets of American Indian religions must be understood. For example, American Indian groups usually do not make a distinction between the secular and the sacred. Their religion is an inextricable part of their lives, integrated into all other traditional aspects of their culture. Places of worship and veneration may be natural features – mountains, springs, and lava

flows. American Indian religious practices are usually the secret and exclusive province of a particular practitioner and are shared only in prescribed ways with certain specified individuals having particular relationships with the practitioner.<sup>15</sup> Holders of traditional Indian beliefs may even feel that misfortune may come to those who share this information with inappropriate parties. Even knowledge that is not considered secret is likely to be private to the native community. Elderly tribal practitioners may hesitate to speak because they are not well acquainted with the English language, or they may remember past legacies of reprisal for traditional religious practices.

The Park Service will develop and accomplish its programs in a way that reflects respect for the religious beliefs, traditions, and other cultural values of the Indian tribes who have ancestral ties to El Malpais and its resources. The Park Service will strive to ensure privacy for American Indians to pursue their religious activities without interference or inappropriate observation by curious visitors who want to learn of Indians' special ways. This will be accomplished by designation of some public use areas as day-use only and by short-term to permanent closure of specified portions of the monument to the general public. The establishing legislation for El Malpais states that the governor of the Pueblo of Acoma and the chief executive officers of other Indian tribes should make recommendations on methods of ensuring access, enhancing the privacy of traditional cultural and religious activities in the monument, and protecting traditional cultural and religious sites (Public Law 100-225, title V, section 507). It is generally the custom of the Park Service to honor the wishes of American Indians regarding religious activities. NPS training programs will cover the etiquette to be followed when NPS personnel encounter religious activities or religious sites and offerings.

### **Subsistence Uses at El Malpais**

Traditional use in the monument is not currently perceived as a major problem by the Park Service. The El Malpais cultural landscape is the product of centuries of traditional use by American Indians and

others. The existing condition of these lands and resources represents a balance achieved through long interaction between humans and the environment. Continuation of the present low level of use poses no additional significant threat to resources. In fact provision for continued traditional patterns of use will probably help maintain the cultural landscape.

### **Trespass**

Visitors may accidentally enter Indian lands while exploring monument lands and unthinkingly intrude upon private religious activities, remove objects of religious significance, or trespass on lands used for grazing and other purposes. Measures to prevent these problems will include signs, fencing, interpretive pamphlets and messages in visitor centers, and routine ranger patrols.

### **Improving Communication Between American Indians and the Park Service**

Federal managers sometimes lack a good working knowledge of the etiquette to observe in talking with Indians. Ignorance of this etiquette may unintentionally offend tribal members and lead to poor communication. For example, managers should not assume that a lack of response from Indian tribes regarding federal proposals indicates no objection to or no interest in the project. The opposite is often true. Because of the egalitarian nature of the decision-making process in some tribes, the opinions of the entire group are sought and weighed before any decision is made. For groups like the Navajo, who live in dispersed homes scattered across large land areas, this means a lengthy process of notification and consultation. Religious matters may be referred to tribal religious leaders, a process which often cannot be accomplished within the short time frames imposed by planning. Meetings should be designed so that location, etiquette, and subjects are meaningful to the groups involved.

Because of good opportunities for a shared approach in identifying the cultural values that will

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15. Adapted from Advisory Council on Historic Preservation's "Draft Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review," August 1, 1985. p.9.

make El Malpais special to visitors, it is especially important for Indian/government interactions to be effective. Communications with American Indians will be routine and forthright, and Indian interests will be given the fullest possible consideration by the Park Service.

Indian tribes differ in their concerns and their feelings about sharing information on subsistence and religious activities, or the treatment of human burials and sacred artifacts. For this reason, the research studies described above and itemized in appendix I will be conducted by qualified professionals who are attentive to concerns of the American Indians. In addition, the Park Service will work with the concerned American Indian groups to develop sensitivity training programs for monument employees and volunteers.<sup>16</sup> Consultation with American Indian groups begun as part of the general management plan planning process will continue in the future, helping to improve understanding and achieve common goals.

## **Research, Documentation, and Evaluation of Cultural Resources**

The cultural resources of El Malpais National Monument include sites, objects, and structures ranging in age from the present to as much as 10,000 years ago, each with differing levels of significance, integrity, and need for protection. A brief description of the types of sites and their significance, condition, and use is found in the "Affected Environment" section.

**Prehistoric and Historic Resources.** Primary among the cultural resource issues at El Malpais is the lack of knowledge about these resources. Much of the past survey work was limited to small areas and was biased or inaccurate. Past surveys have covered only about 1.3 percent of the monument, and most of these surveys have been in areas away from the lava – adjacent to roadways and along the eastern boundary of the monument. Many surveys have been conducted to obtain compliance

for development and have not focused on scientific research. Only a few formal site-specific archeological excavations have been conducted. Many of these have been in areas where large prehistoric structures are visible, an approach that omits whole classes of sites and gives an unbalanced, inaccurate picture of the monument's cultural resource base. Much of the data is also old and was accumulated before modern dating technologies.

In turn, these data insufficiencies preclude efficient management decisions and severely limit prescriptions for treatment and preservation at this time. The lack of knowledge about area resources and their significance does not allow proper comparison of the importance and condition of one site relative to another. It also does not allow assessment of the place El Malpais resources occupy in a larger regional perspective; decisions about which sites to inventory and preserve untouched for future scientific research; and decisions about land acquisition priorities. Without knowledge about the location, significance, and integrity of sites, including the extent of deterioration, the monument staff cannot provide optimal protection and establish priorities for expenditure of time and money. Because there are numerous cultural sites in the few areas of the monument that have been surveyed, the Park Service expects to find many additional sites through future surveys.

Various plans and studies necessary to guide identification, study, treatment, interpretation, use, preservation, and management of the monument's cultural resources are outlined in appendix I. An integrated resources management plan will have high priority. Other plans needed include a research plan (as described in appendix J) to generate and express the rationale behind proposed future scientific inquiry, and an archeological overview and assessment to review, summarize, and evaluate existing archeological data. An archeological evaluation study is needed to determine eligibility of known properties for the

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16. An excellent start has been made in sensitivity training through the efforts of the Ramah Navajo. Also, an informal nonfunded Native American Consultation Committee has been established to improve communication among native Americans who are culturally linked to El Malpais, the National Park Service, and the Bureau of Land Management. This committee will meet periodically in the Grants area to discuss issues and concerns that may affect the preservation and interpretation of native American cultural heritage as well as NPS/BLM operational planning for El Malpais.

National Register of Historic Places. Combined archeological identification and evaluation studies will help define the cultural landscape at El Malpais and, on a long-term basis, will identify and help protect archeological sites. Cultural resource surveys will be synchronized with the natural resource surveys to take advantage of a broad range of professional disciplines and delineate the associations between the two types of resources wherever possible. Other plans and studies needed to guide resource management and potential development are itemized in appendix I. NPS-28 guidelines will be followed in developing standardized information about archeological sites, and information will be in a format that will integrate easily into state-of-the-art data bases (such as the one developed by the Museum of New Mexico's Laboratory of Anthropology). Data regarding the cultural context and location of cultural resources will be withheld from public disclosure according to law.

Archeological investigation, data recovery, and protection can benefit American Indians by preserving elements of their past history and culture and identifying their associations with prehistoric cultures. American Indians, however, may view archeological investigations of prehistoric sites as desecration rather than scientific inquiry. On the other hand, the Park Service has a legal responsibility to be accountable for archeological and other artifactual materials, a responsibility that cannot be arbitrarily dismissed. To effectively manage, the Park Service is also legally responsible to inventory cultural resources and evaluate their national register significance – it is virtually impossible to protect an unknown cultural resource.

Consultation with concerned local American Indians will precede archeological work, and all possible measures will be taken to resolve differences between Indian tribes and federal managers reasonably so that NPS plans and actions respect the cultural context of sites, including those that are ethnographic. Involving American Indians through consultation can help build trust. The Navajo and Zuni tribes have had successful archeological programs in which archeologists and American

Indians worked together to document sites. The U.S. Forest Service has helped develop para-archeology programs involving American Indians. Similar programs may be effective at El Malpais. American Indians can also play important roles as volunteers in observing and reporting evidences of pot-hunting, vandalism, and disturbance of sacred places. Communication about illegal activities will alert managers to the need for stronger or different protection measures.

Burials and sacred objects will be afforded the utmost respect, and the Park Service will consult with American Indians concerning remains associated with these groups (NPS Management *Policies* 5:13). El Malpais managers will establish a prompt and effective notification system to contact and consult with concerned groups. Some of the Indian tribes who traditionally use El Malpais have developed different policies for dealing with the exhumation, study, and reburial of human remains, and federal managers will deal with burials on a case-by-case basis, with an informed awareness of tribal concerns and following procedures outlined in NPS-28 (Technical Supplement 7) and in the NPS Management *Policies* (5: 13).

There is no easy way to determine when prehistoric sites and artifacts with long human use continuing to the present time are to be treated under the American Indian Religious Freedom Act, when these materials should more properly be handled as archeological materials subject to the Archeological Resources Protection Act and the related legislation, or when all these guidelines should apply. Therefore, discovery of significant cultural resources will be followed by protective measures. The Park Service will ensure that proper care and respect are accorded any sacred sites or objects encountered by consulting with American Indian groups who have an interest in these resources.<sup>17</sup>

**Ethnographic Research and Data.** The Park Service needs ethnographic information to manage El Malpais effectively and with regard for American Indians. Because much of the available data is out of date and incomplete, it is inadequate for describing contemporary peoples.

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17. Human burials and grave goods are also discussed in "Managing the Collections" section of this plan for cultural resource management.

There is no real consensus among American Indians regarding the need for ethnographic research. Some tribes recognize that such research can enrich their own historical knowledge and serve to record and hold onto traditional practices and beliefs that are being lost from their culture. Other American Indians find such research an intrusion into their privacy. To help allay this situation, American Indians will have access to the ethnographic information about them, and ongoing consultation will ensure accuracy, respect for American Indian culture, and relevance to the cultural practices that American Indians feel must be protected.

Plans are underway by the Bureau of Land Management to continue the ethnographic program begun with Holmes' assessment of the existing literature (1989). NPS studies needed include a traditional use study (done in correlation with the cultural landscape study) and an ethnographic resources inventory. The traditional use study is especially important with regard to development of the monument's fire and vegetation management plans because vegetation clearing, wildland fires<sup>18</sup>, and reclaiming and revegetating areas could alter the numbers, types, and distribution of plants or other natural resources traditionally gathered by American Indians. The Park Service will consult with American Indians regarding these concerns, and timely completion of a traditional use study will help guide development of future natural resources plans.

An ethnographic resources inventory, identifying areas of special cultural value to American Indians, is important to development of the cultural landscape study. This inventory, identifying areas of special cultural value to American Indians, will be accomplished to the extent possible, in accord with local Indian values and as they are willing to share information. However, it should be recognized that a complete inventory is not realistically anticipated. Sites having traditional cultural values may be only a location where American Indian religious

practitioners have gone historically and still go to perform ceremonial activities, leaving little trace upon the land; locations may be known solely from ethnographic research. Groups may be reluctant to reveal information that might jeopardize the privacy and effectiveness of their religious or subsistence activities.

In addition, El Malpais establishing legislation provides for protection of the privacy of traditional cultural and religious activities in the monument, consistent with the American Indian Religious Freedom Act. In keeping with the spirit of these laws, some ethnographic resources related to contemporary traditional practices in El Malpais will not be inventoried beyond the minimum level necessary for management. NPS regulations and policy require that archeological, ethnographic, historical, and other studies of this nature reflect sensitivity to the privacy of community consultants regarding practices, beliefs, and identities. It will also be monument policy that information regarding the location, nature, and cultural context of archeological, historic, and ethnographic resources be exempted from public disclosure (NPS *Management Policies* 5: 12, 13).

The Park Service may wish to provide technical assistance to American Indians who would like to record and interpret their own cultural history or be represented in the interpretive programs of the monument. Cooperative ventures with tribes to have them produce up-to-date ethnographic data on the uses of plants and other resources have been successful in other areas. By serving as interpreters, local American Indians could contribute valuable perspectives to the interpretive program. The monument staff will work with the NPS Harpers Ferry Center to evolve appropriate media for the interpretive story.<sup>19</sup>

**Evaluation and Compliance.** Because prehistoric, ethnohistoric, and traditional cultural sites are considered potentially significant for listing on the national register until they are evaluated,

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18. See definition of wildland fire in the "Plan for Natural Resource and Wildlife Management" section.

19. See the "interpretation" section of this cultural resources plan and the "Visitor Services/Interpretation Plan" section of the document for further discussion of proactive ideas regarding development of ethnographically sensitive interpretation.

development activities will avoid identified cultural resources whenever possible. American Indians will also be consulted when ethnographic or cultural properties of interest to them are involved.

As surveys and evaluations of significance proceed in the years ahead, national register of historic place nomination forms will be prepared.<sup>20</sup> Where strong American Indian concerns make formal nominations of religious sites to the register impracticable, minimal data necessary for site protection will be maintained in secrecy. Results of evaluations will also guide decisions regarding suitability of sites for research, interpretation, and special treatment or protection. Completed history and archeological reports will help document compliance activities and assist later research.

National register properties will have the highest priority for protection and will receive preservation maintenance. Resources identified as a component of the larger cultural landscape will be managed in this broader context.

A List of Classified Structures has not yet been prepared for El Malpais, but will be as soon as practicable. No potentially historic property will be inalterably changed without consultation with the New Mexico State Historic Preservation Office and the Advisory Council on Historic Preservation.

## Protection of Cultural Resources

The monument's cultural resources, including American Indian religious and subsistence sites, could be affected by various activities and other conditions. These include general "wear and tear" from concentrated use; site misuse, such as camping or picnicking on identified or unidentified sites; possible loss or destruction of historic fabric from adaptive use of historic structures; inadvertent disturbance of archeological sites from development and maintenance of facilities; vandalism and illegal collection of resources; and degradation by natural forces.

The El Malpais establishing legislation strongly emphasizes the preservation and long-term

scientific use of the area's cultural resources. This cannot be accomplished unless sites are protected from threats that would diminish their integrity. Loss of these resources at El Malpais degrades resource quality, destroys scientific information, and deprives visitors of important educational opportunities.

The following discussion proposes some general principles for protecting the monument's cultural resources. The future action plan, the RMP, will draw upon these principles in describing the actions and priorities for specific management projects.

**Natural Degradation of Sites.** Natural processes of wind, water, gravity, fire, expansion of plant roots into sites, and digging by animals have adverse impacts on cultural resources. Cultural and natural resource management will be integrated whenever possible to alleviate this problem; priority sites will be monitored and erosion control and other mitigating measures will be taken.

**Looting and Vandalism.** Destruction of finite, nonrenewable cultural resources that are important to the nation's heritage through looting and vandalism is endemic and epidemic in the United States, and it is occurring at an alarming rate. The government's costs for protecting these resources, in terms of personnel and money, is substantial.

While some visitors do not perceive casual collection of such things as pot sherds and projectile points as a major problem, such collecting is illegal and destroys scientific information. Detailed surface documentation, law enforcement, interpretation, and public education programs will be used to help mitigate these impacts of visitor use.

Because looting is a lucrative way of life for some people, it is important to consider that

Archeological looting and vandalism on public lands are types of illegal, anti-social behavior no different in their basic criminality than other forms of public property theft and defacement. Yet, we have tried to deal with them as if they were unique types of activities and

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<sup>20</sup>. Resources will be evaluated as outlined in 36 **Code of federal** Regulations 60. National register forms will be prepared in consultation with the concerned tribe.

not encompassed by the discipline of criminology (McAllister 1988, 53).

One solution to looting for gain seems to be swift, comprehensive, consistent law enforcement. Increased patrolling by law enforcement officers will be an important deterrent to looting and vandalism at El Malpais. In addition, a monitoring program will be established for sites and areas most vulnerable to human and natural damage. These monitoring and law enforcement programs will be reevaluated periodically to determine their effectiveness. If sites show degradation, additional protection measures will be adopted. Predictive modeling as already developed (Christensen et. al 1988, 62) will be used to help identify areas with special needs for resource protection until the monument's resource inventories can be completed. The model will identify factors that make sites accessible and visible, and the characteristics of the individuals most likely to vandalize or loot sites.

Information about recorded sites and their conditions will be compared to environmental data such as topography, soils, geologic features, and vegetation. The combined data about recorded and postulated sites, vulnerability factors, and environmental conditions will be analyzed to identify areas that may have sensitive resources. Such areas will receive high priority for patrol and archeological investigations, and monitoring programs will be established; the model will be tested against actual site conditions.

Agreements with private landowners, state and federal agencies, and Indian tribes will be sought to increase protection and monitoring capabilities. Law enforcement will be coordinated, and a cooperative law enforcement network will aid in stemming violations.

Archeological Resources Protection Act training courses will be held for all monument employees and volunteers (not just those involved in law enforcement). This training will improve understanding of the types of protected resources; outline successful prosecution methods; help develop new strategies for preventing crimes; and teach damage assessment reporting, case preparation, and ways to improve existing law enforcement efforts.

Informal names of certain shelters and caves in the monument's lava flows are descriptive of features

found there – "Ash Chamber Cave," "Cairn Cave," etc. Unfortunately these names tend to identify areas where cultural resources are or were once found, give the impression that such resources are present, and may increase vandalism. Care will be taken in the preparation of exhibits and publications to avoid this problem.

**Effects of Development.** Surveys of development areas will precede final comprehensive design so that construction will avoid known sites. However, construction of buildings campsites, sewage facilities, leachfields, parking areas, trailheads, trails, and roads could destroy unknown archeological resources. Construction activities will disturb and compact soils, which can alter the horizontal and vertical distribution of buried archeological remains, thereby damaging artifacts and the contextual environment of sites. Prior to any proposed earth-disturbing activities, a professional archeologist will inspect the ground surface for prehistoric or historic remains. If any previously unrecorded resources are found, additional investigations, data retrieval, and evaluation of significance will be completed and mitigations prescribed before actions begin. As questions about mitigating measures arise, they will be resolved in consultation among the Park Service, the Advisory Council, the New Mexico State Historic Preservation Office, and concerned American Indian tribes.

Archeologists will monitor construction in areas where subsurface remains are likely. Where feasible, trail and road alignments will be shifted to avoid archeological resources; otherwise, sampling/collecting/testing procedures will be followed. Priorities for archeological investigations will depend largely on the sequence of development, the amount of existing data, and the potential threat to significant sites; work will also relate to the research plan discussed in appendix I. However, Las Ventanas/Sandstone Bluffs and the Bandera Crater areas will be the top two priorities for intensive survey and documentation because of the high potential of additional sites in these areas.

Wherever feasible, existing historic structures will be adaptively reused in lieu of new construction as required by section 110 of the National Historic Preservation Act. Treatment of these structures will be guided by applicable NPS policies. To avoid improper structural modifications that may diminish the integrity and significance of historic structures

and sites, specific preservation plans for the monument (historic structures reports and preservation guides, research plans, etc.) will be developed and conform to the secretary of interior's standards for rehabilitation. These plans will help avoid the serious cumulative impacts that a series of small unrelated projects would have on the total resource over time.

Stabilization and maintenance of prehistoric structures will follow similar preservation standards. The physical properties of original building materials and construction techniques will be documented archeologically and/or architecturally prior to stabilization activities, and preservation plans and guides will be developed for their future care.

At all monument development areas, design will be compatible with the cultural landscape, respecting the original landform. American Indians will be consulted prior to design of roads, trails, and facilities throughout the monument, and their advice will also be sought on appropriate means of protection for important resources. The monument staff, in consultation with American Indian groups, will find solutions to potential conflicts between visitor use, trespass, and Indian traditional uses. Provision will be made to avoid construction and public use during primary periods of religious activity. Most religious use in the vicinity of **Bandera** Crater will likely occur in winter when there are few visitors. The superintendent and concerned American Indians will work out this closure and others to protect privacy.

Design of facilities will provide the highest feasible level of physical **access** for disabled persons consistent with the preservation of significant prehistoric, historic, and ethnographic attributes. Design and installation of facilities for handicap access will be in a manner that least affects historic qualities; if modifications would compromise significant historic fabric of the property, they will

not be made. Design will involve experts in both accessibility and historic preservation.

#### **Protecting Resources from the Effects of Use.**

Sites adjacent to facilities, roads, and trails may suffer secondary impacts from visitor use -that is, "wear and tear" from foot traffic and recreational activities. Intensive surveys and evaluations will be completed for areas likely to receive secondary impacts, and mitigations will be prescribed.

Protective measures such as restrictions on visitor access will be designed to reduce impacts on sites. Informal foot trails and vehicular ways that lead to sensitive archeological sites will be blocked and the tracks revegetated. Sites that have had extensive past disturbance may be backfilled to lessen their visibility. Ruins and historic structures will be stabilized as appropriate. Well-defined self-guiding trails and other such structured activities will discourage visitors from leaving designated areas and collecting or inadvertently disturbing the privacy of American Indians. The Park Service will use the permitting process to direct backcountry visitors to areas of particular interest while minimizing impacts on sensitive natural and cultural resources.

Numerous rock cairns (stone markers) have been put on the lava by pothunters, spelunkers, and others. Although some cairns mark contemporary routes, others are undoubtedly prehistoric, and some may be related to use by contemporary American Indians. Extreme care will be taken to protect and leave in place those cairns that mark prehistoric routes or features currently used by Indians.

Recent historic preservation legislation requires federal agencies to inform the public about the problems involved in protecting cultural resources. Public involvement and education programs will be developed at El Malpais to help visitors understand the science of archeology and the problems caused by looting. Public involvement will increase volunteer activity in resource protection, which has

been found to be the most effective means of dealing with hobbyists and casual collectors. Changing the attitudes that lead to theft and defacement is crucial. New attitudes eventually lead to extralegal sanctions, such as peer disapproval and stronger moral standards. Some existing programs may be used.<sup>21</sup> NPS managers will determine the most effective programs to accomplish the following goals:

- to foster a feeling of ownership and responsibility for our common heritage
- to increase public understanding of the science of archeology
- to enhance public awareness of the current threats to archeological resources
- to increase understanding of how the public's actions affect archeological resources
- to increase public involvement in legitimate archeological activities

## Managing the Collections

Museum objects and collections, study collections, archeological materials, natural resource specimens, exhibits, and interpretive items are essential to achieving the purposes of the monument, including scientific research, historic preservation, and interpretation and education. Besides natural and cultural objects, collections include field notes, photographs, oral histories, building plans, maps, archival records, letters, etc., dealing not only with history but with the disciplines of paleontology, geology, biology, anthropology, and archeology.

At present the monument has no formal collections, no collections storage, and no collections policy. Guidance for acquiring objects and documents that contribute directly to the understanding and

interpretation of the monument's themes will be provided by a scope of collections statement. An interim scope of collections statement consistent with the *NPS Management Policies* (4:4 and 5:10) and NPS-28 will be developed immediately by monument staff in consultation with the regional curator to guide accession policies until the final scope of collections statement can be completed. This interim policy will coordinate with BLM collections policies wherever feasible.

Guided by the scope of collections statements, the Park Service will acquire by purchase or donation relevant artifacts, photographs, field notes, oral histories, and other supporting data from various sources (including private interests and public institutions) to establish a baseline collection for exhibits and interpretation. For example, various items and furnishings that are currently part of the privately owned trading post at Bandera Crater are important to interpretation of the themes of volcanism, prehistory, and tourism and recreation and may be acquired.

It is important that items of historical or scientific interest be evaluated in their own right, not just acquired as part of a package collection or with other property acquisitions. Items determined to be significant and relevant to monument purposes will have high priority for acquisition. The Park Service will acquire only those collections with a legal and ethical pedigree, in accordance with existing laws and management policies (*NPS Management Policies*, 5:10).

Some artifacts from prehistoric sites currently used by American Indians for religious purposes may be considered by them to have special religious significance. American Indians may present a strong claim for some such items, arguing a long continuum of site use, especially at those sites they perceive as ancestral. However, because the Park Service has legal responsibilities to be accountable for the archeological artifacts from lands it manages, determination of responsibilities and

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21. The NPS Archeological Assistance Program, the NPS Listing of Education in Archeology Projects, state and local programs about protection of resources (including teacher training kits, special exhibits in public buildings, cultural design competitions, crafts shows, newsletters, and adopt-a-site and stewardship programs), and public involvement programs (where volunteers do anything from displays and programs to actual on-site and laboratory activities under the supervision of professional archeologists, architects, and historians) are among some of the choices management has. Informed volunteers become avid resource advocates and often contribute their own professional expertise, saving the Park Service appreciable amounts of money and resources.

treatment of these individual items will be handled on a case-by-case basis under NPS-28 and the NPS Management Policies. At the same time, it is important to continue to consult with American Indians, working out the most feasible approach to management of the resources that are significant to these contemporary peoples.

Requests for repatriation (return) of objects and materials to American Indian groups or individuals will also be handled on a case-by-case basis. The National Park Service will repatriate museum objects when lawful and when it can be demonstrated by a American Indian group that the materials are their inalienable communal property (NPS Management Policies 510).

A collections management plan will be developed to guide the management of monument collections. Accessioning, cataloging, and storing collections will follow this plan and the procedures outlined in NPS-28 and the *Museum Handbook, Parts I and II* (NPS 1984).

Future disposition of collections and objects will be guided by the NPS policies and guidelines mentioned above. Archeological materials will not be disposed of without consultation with and permission of the regional curator. Dissemination of information to the public or researchers regarding archeological and anthropological materials and other sensitive topics may occur only in accordance with policies governing release of confidential data (NPS Management Policies, 5:12 and 8:9).

Once the basic collections management documents have been developed for El Malpais, a concerted effort will be made to locate, inventory, and photograph artifacts and documents previously removed from El Malpais through archeological investigations or private collecting. Records from past surveys and archival materials held by public institutions should be microfilmed and added to the monument collection to assist managers, researchers, and interpreters.

The monument currently has no storage facilities for collections. Adequate space will be provided at monument administrative headquarters in Grants. An interim collections storage plan will be developed to guide this effort, and the plan will become part of the later collections management plan. Collections storage will be in agreement with NPS-28 (3:16), which requires that collections be

housed in secure and safe storage facilities that are not in the same room with incompatible activities or materials. This space will be of a suitable nature, spatially adequate, well organized, and environmentally safe and stable. Appropriate fire protection and physical security will also be provided.

The space leased in Grants is unlikely to meet all NPS standards for collections storage. Materials requiring special environmental controls will be transferred to the NPS Western Archeological and Conservation Center.

## Interpretation

The monument's interpretive programs will deal with natural and cultural resources themes specific to El Malpais, as described in the "Visitor Services/Interpretation Plan" section. Many visitors are deeply interested in the archeology, history, and ethnography of the Southwest, themes that are all relevant to El Malpais.

The unique constellation of landforms, plants, animals, and traditional human uses of El Malpais suggests that interpretative themes should present a holistic and integrated view of all these resources. This multidisciplinary approach to cultural resource research and interpretive exhibits and programs can result in exciting educational opportunities and experiences for visitors.

Cultural sites and structures vary widely in their visibility and attractiveness, and many are not particularly interpretable. Accessible sites that are appealing, highly visible, and have interesting stories will receive a high priority for research if they also have the potential to enrich interpretive programs.

Various ethnic groups may understand the meanings of different words in many different ways. In addition, there are different names for geographic features. American Indians are familiar with traditional names given to these features long ago and may not always recognize the current Spanish or Anglo names. Therefore, in pursuit of properly defining the cultural landscape, alternative traditional names for landmarks will be fully considered. This could make maps, exhibits, and interpretive programs more interesting to everyone.

Traditional arts and crafts may need to be acquired for interpretive exhibits, but NPS policies will be followed to ensure that no sacred objects like medicine bags, bundles, pipes, masks, and effigies will be acquired and displayed, and that other items are treated in an appropriate manner.<sup>22</sup>

NPS *Management Policies* provide for active consultation with concerned American Indian groups to plan, develop, and operate interpretive programs that relate to the history and culture of these groups. Indigenous groups, particularly American Indians, are one of the monument's most important cultural resources. Contributions of American Indian stories, poetry, traditions, and insights enrich and strengthen the interpretive story.

The interpretive programs must convey to the visitor a sensitive and respectful view of contemporary American Indians, Hispanics, and others whose lives are intimately connected with El Malpais. The Park Service will work with these groups in preparation of information and media. By serving as interpreters, local American Indians could contribute valuable perspectives to the interpretive program. Programs dealing with ethnographic topics will be as factual and balanced as possible. What is said to the public will be information only at levels acceptable to traditional Indian authorities and will be only information that contributes to better understanding of the Indian perspective about the El Malpais landscape. In addition, the monument staff will also work with the NPS Harpers Ferry Center to evolve appropriate media for the interpretive story.<sup>23</sup>

The *Final Joint Management Plan: Chaco Archeological Protection Site System* (NPS 1983b) identified Las Ventanas as an important outlier within the larger prehistoric Chacoan system and calls for a unified approach to interpretation of sites within the system. The monument staff should

involve themselves in the Interagency Management Group as a way to better understand the site and to coordinate interpretation with that presented at other major outliers.

## THE PLAN FOR NATURAL RESOURCE AND WILDLIFE MANAGEMENT

### Introduction

El Malpais National Monument is one of the newest additions to the national park system, and the status of many of its natural resources is uncertain. Although several studies have been conducted in the area, especially geologic studies, data about other natural resources are sparse. A resources management specialist has only recently been hired at the monument, and the development of a resource management program is only now beginning.

This initial or interim plan for managing the natural resources, as contained in this section, is required by the legislation that established the national monument/conservation area. The legislation also calls for a separate wildlife management plan, but because of the interrelationship of all natural resources, including wildlife, wildlife management proposals are incorporated into this interim plan rather than in a separate plan. In addition, consultation with the New Mexico Department of Game and Fish (NMDG&F) and the U.S. Fish and Wildlife Service (USFWS) has revealed no major monument wildlife issues. Consultation with the NMDG&F and the USFWS will continue on any future plans relating to monument wildlife.

This plan for managing natural resources will state preliminary natural resource objectives; address management status, issues, and needs based on a preliminary evaluation of available data; and

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22. "The National Park Service will not exhibit native American disinterred skeletal or mummified human remains or photographs or replicas of them. There will be no display of grave goods or other objects if native Americans who are culturally associated with them object to such exhibit. Associated native American tribes and groups will be consulted to determine the religious status of any object, the sacred nature of which is suspected but not confirmed, before it is exhibited or before any action is taken" (NPS Management **Policies**, 7:5).

23. See "Visitor Services/Interpretation Plan" section for further discussion of proactive ideas regarding development of ethnographically sensitive interpretation.

present interim actions that will be taken.<sup>24</sup> A future resources management plan (RMP), which includes natural and cultural components, will be written based on expanded resource knowledge as well as growth in management experience with the resources.

The EI Malpais legislation ensures access to American Indians for traditional religious and subsistence activities, including gathering of pinyon nuts. These concerns were addressed earlier in the cultural resource portion of this plan in the section on subsistence uses.

### **Objectives for Managing EI Malpais' Natural Resources**

Natural resource objectives, as specified in EI Malpais National Monument legislation are that

the Secretary [of the Interior] shall protect, manage, and administer the monument for the purpose of preserving the scenery and the natural . . . resources of the monument and providing for the public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

In support of legislative intent, the monument's interim natural resource management objectives, by management topics in priority order, include the following:

**Interpretation** - To develop and conduct natural resource interpretive programs that help preserve natural resources through public understanding and appreciation of natural ecosystems.

**Visitor Use** - To identify and regulate appropriate recreational uses such as hiking, caving, picnicking, and camping and to monitor all areas for effects of these activities based on ecosystem tolerance; to develop recreational facilities and provide backcountry

information and permits that are designed to limit resource impacts.

**Law Enforcement** - To protect the natural resources by providing trained personnel to enforce applicable laws and regulations; to establish cooperative agreements with other government organizations, local law enforcement agencies, and private landowners to assist in the protection of monument resources.

**Facility Development** - To develop facilities that are harmonious with and blend into the surrounding environment, using natural materials whenever possible; to avoid overdevelopment of facilities; to provide a monument collection facility for protection and storage of natural resource collections.

**Scientific Research** - To establish research programs that identify, evaluate, monitor, restore, and maintain/preserve natural resource values and ecological processes.

**Cooperative Planning** - To work with local, state, and federal agencies to assist in achieving mutual management goals and objectives.

### **Natural and Wildlife Resource Status and Needs**

**Lack of Information.** Baseline data on resources such as soils, flora, fauna, hydrology, air quality, and fire history are incomplete. Approximately 95 percent of the monument is lava terrain that is rugged, generally inaccessible by vehicles, and difficult to traverse on foot. Few inventories or research have been done because of these conditions. The Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Soil Conservation Service, state of New Mexico, University of New Mexico, and individuals such as ecologist Alton Lindsey have conducted various studies of the biota of the area, but most information is dated and limited in value for monument management purposes. (In contrast, studies of volcanic phenomena by geologists have

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24. Because information on the significance of the monument's natural resources can be found in the "Affected Environment" section of this general management plan, this information is not repeated here.

been extensive, and the highlights of these publications are summarized in the "Affected Environment" section of this document.)

As part of the planning process, current data have been collected and initial evaluations have begun. Recent inventories include a lava tube inventory (NPS Carlton 1988b) and a lava surface features inventory (NPS Carlton 1989a). A grazing management plan is being prepared by monument staff and the NPS Southwest Regional Office. Comprehensive vegetation and soils mapping, which includes the monument, is being performed by the Bureau of Land Management in conjunction with their planning process. The Soil Conservation Service is completing a comprehensive soils survey of Cibola County (including all of the monument).

However, much remains to be done. Large areas of the monument remain uninventoried. Additional data collection, research, and monitoring are needed to help identify the current condition of natural resources and immediate or potential threats before comprehensive protective measures are prescribed. The identification and documentation of the condition of all natural resources is essential to formulation of future management strategies to protect and preserve monument natural resources. Knowing the status of all natural resources will provide a baseline against which changes can be measured and appropriate management actions taken. Limited and incomplete data would make management decisions speculative, possibly resulting in mismanagement, including degradation or destruction of resources.

To remedy this critical deficiency, a more thorough inventory and evaluation of natural resources will be performed on a high priority basis. Quality copies of past reports, studies, and maps will be obtained. Information will be compiled and stored in an integrated and retrievable system for efficient use. Some ground-truthing and data adjustments may be necessary. Data will be made compatible by standardizing map scales, nomenclature, and other parameters. Additional inventories and studies relevant to management needs will be identified and initiated.

### **Reclamation/Revegetation of Damaged Areas.**

Several areas in the monument have been damaged from past and present resource exploitation. Affected sites include one active and two inactive cinder pits, a 25-acre earthen and lava rock borrow area, an abandoned sandstone quarry, and several miles of vehicular ways. Two of the cinder pits, the borrow pit, and the sandstone quarry are on private land within the monument boundary. The vehicular ways, several of which are on private land, historically provided access for timber and livestock operations and possibly hunting, but many no longer provide any legitimate use. Large scars resulting from human activities, some on steep slopes, are resulting in major erosion problems and are visual intrusions. These disturbed soils cause a proliferation of exotic vegetation and a loss of wildlife habitat. Vehicular ways are still occasionally used by monument visitors who believe they are designated roads, which they are not. Continued use, even occasional, results in continued degradation of resources. Natural restoration takes a long time because of compacted soils and continuing erosion on steep slopes.

To alleviate this damage, extensive reclamation/revegetation efforts will be undertaken. Restoring the cinder and borrow pits and some of the vehicular ways that are on private land would require federal acquisition of some properties. Ways not on private property and considered nonessential will be officially closed or their use restricted by gates or barriers.

**Air Quality Management.** The monument is designated a class II area under the 1977 Clean Air Act (42 U.S.C. 7401 et seq.). The act establishes maximum allowable increases beyond baseline concentrations of sulfur dioxide, particulate matter, and nitrogen oxides – increases that cannot be exceeded at a class II area.<sup>25</sup> Section 118 of the act requires the monument to comply with existing federal, regional, state, and local air pollution control laws and regulations.

Visibility/air quality is a primary monument resource. The air in Cibola County and El Malpais

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25. A national monument automatically becomes a class II area when established. However, it appears that the air quality at El Malpais may be worthy of a higher standard, and the Park Service would cooperate with the state to raise the standard if further studies show that a higher designation is warranted.

either meets or is better than the National Ambient Air Quality Standards (NAAQS) established for all criteria pollutants (sulfur dioxide, total suspended particulate matter, ozone, carbon monoxide, nitrogen oxides, and lead). Currently, El Malpais air quality appears to be excellent except for occasional short periods of regional haze. However, there is no monitoring within the monument, and no monument-specific determination of compliance with federal and state sulfur (SO<sub>2</sub>) and nitrogen (NO<sub>2</sub>) oxides, suspended particulates, or other air quality standards. There is insufficient data to determine soil, vegetation, and water quality conditions as they relate to air quality.

There are no major sources of air pollution in the immediate vicinity of the monument; however, there are major sources of pollution in the region that could impact the monument's air quality. These include coal-fired power plants at Thoreau, New Mexico (50 miles away, which burns about one million tons of coal per year), Farmington, New Mexico (125 miles away), and Holbrook, Arizona (175 miles away). Construction of a second 233 megawatt coal-fired power plant near Thoreau is being considered. The proposed Bisti coal-fired power plant, which would be about 85 miles north of El Malpais (near Chaco Culture National Historical Park), could also have an adverse impact on the monument's resources if it is constructed.

Mining, another potential source of pollution, is a major economic activity in western New Mexico. The El Malpais region contains several large coal fields, and increased energy development in the region could threaten existing air quality levels. The uranium mining and milling near Grants, a possible source of particulate matter, is essentially shut down. The nearest copper smelter is in Hurley, New Mexico, 165 miles southwest of the monument. Other smelters are in El Paso, Texas, southeastern Arizona, and northern Mexico.

Fossil-fuel combustion results in increased SO<sub>2</sub> and NO<sub>2</sub>. Concentrations of these pollutants are known to be harmful to a number of fragile plant species, some of which are found in the monument. These include Douglas fir, ponderosa pine, and lichens. The monument contains over 70 identified lichen species. Lichens, when moist, absorb gases over their entire surface and are extremely vulnerable to injury induced by elevated levels of SO<sub>2</sub>; as such, they can be used as bioindicators of ecosystem air pollution stress. In cryptogamic associations with

various algal species, lichens play a crucial role in the stability and health of arid shrub and grasslands such as those at El Malpais. A lichen study in 1984 found no indication that the lichen were being affected by pollutants at that time (DeBruin 1984).

To better protect the monument's air quality, including the atmospheric quality of viewsheds and the protection of the monument's flora and fauna, air quality data will be collected and documented. Monitoring and testing studies will be conducted to determine levels of gaseous pollutants, particulate matter, and acid deposition levels at El Malpais. The monument staff will work with the New Mexico Air Quality Bureau to ensure that all internal activities meet the requirements of the New Mexico State Air Pollution Control Implementation Plan (SIP) (40 CFR 52.1620 ff, approved July 1, 1988).

### **Management of the Monument's Visual Quality.**

The visual quality of the monument greatly influences the visitor's overall recreational, educational, and spiritual experiences. Landscapes and viewsheds both within and outside the monument are critical resources and contribute greatly to the aesthetic values of the monument. Key landforms within the monument, such as Sandstone Bluffs, Cerro Bandera, Bandera Crater, and others are described in the "Affected Environment" and "Visitor Services/Interpretation Plan" sections. Key landforms outside the monument that can be clearly seen from within the monument include Mt. Taylor (north – a shield volcano and the highest peak in the region), Chain of Craters (west), the Sawtooth Mountains (south), Mesa Negro and Cebollita Mesa highlands (east), and the Zuni Mountains (northwest). Another important aspect of the monument is the vast expanse of open volcanic badlands that give the visitor an appreciation for the extensive geological activity that took place in the area.

Management practices inside and outside the monument can affect visual quality. Impacts outside the monument include scars from mining and ranching operations, powerlines, and roads. Within the monument borrow and cinder pits, heavily grazed and timbered areas, roads, powerlines, and buildings also impact visual quality.

To mitigate visual impacts and prevent further impacts, the monument staff will work cooperatively with private landowners, local governments, federal agencies, and others. Also, the monument facilities

will be carefully designed -to harmonize with the surrounding landscape. Areas disturbed will be revegetated and restored to their natural appearance.

**Fire Management.** Only 20 years of fire data has been collected, and during this time there have been about 100 natural wildfires in and near the monument. Most have been small, less than 1 acre, but several large fires have occurred (10,266 acres in 1976, 40 acres in 1980, 400 acres in 1984, and 90 acres in 1988). Four fires in 1989 resulted in 6,500 acres burned. The effects of these fires on vegetative composition has not yet been evaluated.

El Malpais National Monument is developing a fire management plan (anticipated completion is early 1990). The current practice is total suppression, and this will continue until a plan to determine future actions is developed and approved by the Boise Interagency Fire Center. The plan will address management of wildfires and prescribed fires.

Past buildup of natural fuels due to full fire suppression policies require that the Park Service use hazard fuel reduction techniques to restore a natural balance.

Also needed is a fire ecology research program to provide information on fire history, ecological effects from past fires, fuel-load buildup areas, and other data. The importance of naturally caused (lightning) fires in maintaining biotic diversity is well recognized. A fire ecology research program would also determine prescriptions for specific wildland fire<sup>26</sup> management techniques that would assist with the comprehensive management of monument flora and fauna, prevent damage to cultural resources, and perpetuate natural ecosystems. A fire management plan that is compatible with BLM and USFS fire management practices will be developed in accordance with the "Final Report on Fire Management Policy" (U.S. Department of Agriculture/Department of the Interior 1989).

**Water Management.** In the monument's establishing legislation, Congress directed the Park Service to preserve the significant natural and cultural resources of the lava flow areas and manage them for the benefit and enjoyment of present and future generations. Preserving the natural resources includes the roles that naturally occurring water plays. As explained in the "Visitor Facility/Development Plan" section, attempts are being made to acquire these water rights.

**Boundary Survey and Identification/Marking.** El Malpais National Monument has approximately 130 miles of irregularly shaped boundary, which has not been officially surveyed or, in most areas, marked. (An official [legal] description of the boundary has recently been prepared and transmitted to Congress.) Without an official survey and clearly visible boundary markers, monument land could be mistaken for land outside. Adverse impacts may result – illegal woodcutting, hunting, poaching, and disputes with adjacent landowners. To adequately protect monument resources, the boundary will be surveyed, monumented, and marked/fenced.

**Backcountry/Wilderness Management.** Although the rugged backcountry lava areas seem undamageable, many fragile resources are present. As visitation grows so will the demand for backcountry use, and impacts to resources will likely result. Also, 83 percent of the monument appears suitable for wilderness designation and must be managed to protect wilderness qualities and values until Congress takes formal action (see "Wilderness Suitability Study" section of this document).

To manage the demand for recreation and assist in resource protection and backcountry search-and-rescues, a permit system has been established and is in use. The permit system ensures that backcountry users fully understand the regulations, requirements, and inherent backcountry dangers and aids in the protection of natural and cultural resources.

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26. According to the "Final Report on Fire Management Policy," there are two kinds of wildland fires – "prescribed fires and wildfires. Prescribed fires may be ignited by managers, or naturally occurring fires may be allowed to burn, under specified conditions to achieve established management objectives. Any other fire is considered a wildfire, and appropriate suppression action is taken on all wildfires."

A **backcountry/wilderness** management plan will be prepared to protect the primitive character of the terrain and will include provisions for managing use and protecting the resources. It will include continued use of the **backcountry/wilderness** permit system and establishment of a resource monitoring program. Standards and restrictions for uses such as trail marking, camping, campfires, toilets, and other activities will be defined. Methods of controlling off-road use will be prescribed. Planning will include consultation with American Indians.

**Grazing Management.** Livestock grazing has occurred in the monument for approximately 150 years. Sheep were originally the major domestic grazer; now it is cattle. There are several existing grazing allotments in the monument, but as specified in the El Malpais legislation they will expire at the end of 1997. Until this time, provisions must be made for operators to maintain herds and associated ranching developments such as stock tanks, pipelines, fences, and corrals. Ranching developments on federal land will be removed (after assessments of sites and structures to determine if they have historic values). El Malpais staff is preparing a grazing management plan with assistance from the NPS Southwest Regional Office to address the many issues related to grazing. Grazing often results in adverse impacts on resources, including wildlife, vegetation, soils, cultural sites, and recreation. The full effect of past and present livestock grazing on monument resources is unknown, and as a result a program to document the impacts from grazing will be recommended.

**Lava Tube and Ice Cave Management.** The monument contains extensive lava tube systems. A lava tube inventory (NPS, Carlton 1988b) was conducted shortly after the monument was established, but because of limited time and funds this survey was not comprehensive. The contractor explored and documented the 16-mile central tube system within the **Bandera** lava flow and several miles of tributary tubes. Other lava tubes in the monument have yet to be studied.

Accessible caves are very popular with visitors. Caving is also a hazardous recreational activity. The number of cave visits is unknown, as is the extent of impacts. Human use is likely disturbing fragile cave features including biota and mineral and lava formations. Research and more complete lava tube inventories are needed.

Caves as well as lava surface resources hold special significance to local American Indians. This concern is recognized by the Park Service, and measures are needed to ensure that American Indian interests are protected.

Several tubes containing ice formations are referred to as "ice caves." These caves may contain water and/or temperature-sensitive resources. The ice may preserve important prehistoric atmospheric, climatic, and vegetative (pollen) data. Very little is known of the dynamics of ice formation or the impacts of visitors. Research and monitoring are needed to determine the distribution and dynamics of ice formation, annual/seasonal cycles that influence ice formation, conditions needed to ensure permanence of ice, ecologic conditions and species associated with the ice caves, and effects of visitation on the ecology of ice caves.

To obtain the needed data, additional lava tube and ice cave inventories and research will be done. A comprehensive cave management plan will be prepared. The plan will determine specific management policies and appropriate use levels, identify long-term monitoring needs, and develop measures to protect cave resources including ice.

**Wildlife Management.** The status of monument wildlife is only partially known. Wildlife inventories are incomplete, and the extent that wildlife species use the different habitats in the monument is unknown. More information is needed, including species density, population numbers, range conditions, historical use, and identification of critical habitat. It is assumed that the lack of water and rugged terrain will continue to be limiting factors for monument wildlife.

Management objectives will be to perpetuate native wildlife species and natural population numbers, to be accomplished through protection and enhancement of critical habitat and prevention of illegal hunting and trapping. Supplementation and reintroduction of certain species may be feasible and, if so, will be coordinated with appropriate state and federal agencies. Wildlife protection will be encouraged on public and private lands within and adjacent to the monument through the establishment of cooperative agreements. Extirpated wildlife species such as bighorn sheep will continue to be studied for possible reintroduction (see later section on reintroduction of bighorn sheep).

**Bats** – El Malpais provides both summer and winter habitat for a variety of bats including the Mexican free-tailed; Townsend's big-eared; hoary; pallid; and several species of myotis, including long-eared, fringed, long-legged, and small-footed. There is far less chance that the monument provides habitat for others, including silver-haired, big brown, and spotted bats. Several of these species are listed as federal notice of review species (category II), which means there is concern the species is in jeopardy but information is insufficient to decide on official listing as a threatened or endangered species (see later discussion on threatened and endangered species).

Several bat caves/colonies exist in the monument, but by far the most popular for visitors is Bat Cave near El Calderon. The cave provides summer habitat for a large colony of Mexican free-tailed bats and winter habitat for a much smaller population of various species including the Townsend's big-eared bat (a federal notice of review species). Evening bat flights are a popular visitor attraction in summer and, although not promoted, popularity is increasing. During the 1950s, ecologist Alton Lindsey estimated the summer Mexican free-tailed population at Bat Cave at approximately 40,000 bats. Today, the population may be as low as 6,000. The reasons for decline are unknown, but from studies done on the Mexican free-tailed bat colony at Carlsbad Caverns National Park and other management experience it has been found that bat colonies in general were affected by ingesting pesticides on the insects they eat. Also, the impact of past visitors entering Bat Cave at El Malpais is unknown and is possibly a contributing factor. Smoke or shining lights on sleeping bats will adversely impact the colony. An ecological study is needed to determine bat habitat and population, migration patterns, local impacts on this colony, the effects of increased visitation on the colony, and what other potential problems may exist. Although there is particular interest in obtaining information about the Mexican free-tailed bat colony and the population of Townsend's big-eared bats at El Calderon, this information is also needed for other bat species and colonies in the monument.

Disturbances to the bat population near El Calderon will be mitigated by ranger patrols, closing the cave by signing, and educating visitors to observe the bat flights from restricted areas. If these measures are not effective, additional protective measures will be prescribed.

Other problems related to bats are that they carry and can transmit disease to humans, including rabies and histoplasmosis. Visitors will be warned about these dangers, which will help reduce the potential for disease transmission.

**Mule Deer** -The monument mule deer population is probably small. The major limiting factors are lack of water and the rugged lava. The northern part of the monument near El Calderon appears to have the greatest deer concentration, its shrub-conifer and deciduous vegetation providing excellent summer and winter habitat.

The NMDG&F performs a local hunter license census on game populations including mule deer. However, this census does not provide accurate estimates on monument wildlife populations because hunting is prohibited in the monument and state hunting units do not coincide with the monument boundaries.

Information needed on mule deer includes their population, identification of migration patterns and routes, location of summer and winter range, and buck:doe:fawn ratios.

**Elk** – Elk are neither numerous nor permanent monument residents. They occasionally use areas near **Bandera Crater**, however this use is inconsistent and probably only transient. Lack of water is likely the limiting factor.

**Turkey** – The turkey population in the monument is unknown. Sightings are frequent near East Rendija. A preliminary estimate by NMDG&F personnel indicates that the monument once provided suitable habitat for a much larger number. As with mule deer, major limiting factors are most likely lack of water and the rugged terrain.

Information needed on turkeys includes their population, existing and potential habitat locations, and tom:hen ratios.

**Pronghorn** – Pronghorn occupy the monument in the area south of the Laguna flow. Areas along the southern monument appear to provide adequate forage, however water is very limited. Areas just south of the monument support pronghorn, but there is a high fawn mortality. The reasons for the high mortality are unknown, but may be predation, lack of food and water, and competition with cattle.

Information needed includes a population estimate.

**Raptors** – The monument supports several raptor species, including kestrel, prairie, goshawk, red-tailed, Cooper's, and rough-legged hawks; great horned, pygmy, long-eared, and burrowing owls; and turkey vultures. Golden and bald eagles are occasionally seen foraging in the monument. The sandstone cliffs east of the monument provide raptor nesting habitat, and cave entrances and collapse structures provide owl nesting habitat. However, nesting has been declining in recent years for unknown reasons. Raptor poaching occurs elsewhere in the United States, but it is not known if it is a problem in the El Malpais area. Carcass poisoning to control coyotes likely results in some raptor mortality.

Important raptor nesting/foraging areas need to be identified, and actions need to be developed to protect these species.

**Black Bear** – Black bear are occasionally seen in the Bandera Crater area. Bears are not now a serious problem, but with development of monument facilities, human/bear encounters could become a problem in the monument.

Black bear habitat and numbers need to be determined. A bear management plan may be needed if human/bear encounters begin. Because bears are so wide ranging and peripheral areas may be involved, bear management strategies should be developed in cooperation with state and federal

agencies. Monument facilities such as the campground and residences may need to be designed with consideration of potential bear problems, and animal-proof trash containers will be used at developed areas.

To systematically increase information about wildlife and improve management decisions, population inventories and habitat studies will be conducted. As needs for specific programs are identified, cooperative wildlife management agreements with state and federal agencies and appropriate consultation with local American Indian groups will be established. Species management plans will be developed as needed.

### **Threatened and Endangered Species**

**Management.** Management of threatened and endangered plant and animal species will be as follows.

**Plant Species** – The potential exists for the presence of certain proposed or nominated threatened, endangered, or federal "notice of review" plant species within the monument. However none were identified during a survey of representative area habitats completed in 1979. The survey recommended a late-season inventory to better identify late-flowering threatened and endangered species; this additional survey was never performed. Federal notice of review species do not yet have legal protected status, however NPS mandates require protective measures for all species including notice of review candidates.

**Animal Species** – There are numerous threatened (t), endangered (e), and federal notice of review (r) animal species known (k) or having potential (p) to occur in the monument. These include the peregrine falcon (e, p), bald eagle (e, k), black-footed ferret (e, p), Townsend's big-eared bat (r, k), white-faced ibis (r, p), Swainson's hawk (r, p), ferruginous hawk (r, p), spotted bat (r, p), mountain plover (r, p), long-billed curlew (r, p), "western" yellow-billed cuckoo (r, p), and "southern" spotted owl (r, p).

Further information is needed about monument use or critical habitat of the above-listed animals or any other threatened or endangered species that are discovered.

To identify and protect potential threatened and endangered and federal review species, a two-phase approach will be taken. The first involves survey and assessment of all proposed development sites for these species. The second involves completion of a monument-wide survey. If threatened, endangered, or federal notice of review species are identified, protective measures will be developed in consultation with the USFWS. These protective measures will include thorough determination of distribution, monitoring, and protection of habitat.

**Vegetation Management.** There is no detailed, comprehensive inventory of monument vegetation. The Bureau of Land Management has used remote sensing to develop a small-scale (1 :100,000) vegetation map that includes the monument. The map identifies eight vegetative communities in the monument. However, on a larger scale, little information on plant communities is available, and BLM's data is not adequate for site-specific planning and specific resource management actions and decisions. The rugged lava has prevented identification and exploitation of monument vegetation, including vegetation in many backcountry areas and kipukas (which are isolated islands of older rock and vegetation surrounded by lava flows). Initial evaluation shows fragile species and unusual plant associations, including uncommon lichen species and grasses, in certain kipukas and other restricted habitats such as caves and crevices indicates. Two New Mexico sensitive species, grass fern (*Asplenium septentrionale*) and maidenhair spleenwort (*Asplenium trichomanes*) were identified in a 1979 survey. Some kipukas have such undisturbed and vigorous associations of native species as to suggest the possibility of establishing one or more research natural areas.

As described earlier, livestock have grazed in the monument for at least a century. Grazing has likely altered the native vegetation and introduced exotic plant species, but the extent is unknown.

As backcountry/wilderness use increases, the potential for impacts on vegetation will also increase. Sensitive plants could be damaged or destroyed, possibly resulting in the loss of some plants. Plants and vegetative associations need more thorough study of significance, and if appropriate, one or more research natural areas will be established to ensure preservation and to assist in long-term research needs.

To improve management of the monument's vegetation, detailed inventories and studies will be conducted and a vegetation management plan will be prepared. Plan components will include reestablishment and maintenance of native plant communities and identification and elimination of exotic species. If necessary, an exotic species management plan will be prepared. If sensitive species are present in areas proposed for development, protective measures will be taken. The vegetation management plan will be developed in conjunction with the fire management plan, the grazing management plan, the threatened and endangered species surveys, the cultural resources management plan, and other appropriate plans and studies. Also, although the Park Service has no legal requirement to do so, measures will be taken to protect the two sensitive state species (mentioned above) where they occur.

**Reintroduction of Bighorn Sheep.** It is not known how or when the bighorn sheep population – once native to the monument – was extirpated; however, this species still inhabits areas of the Zuni Mountains just west of the monument. Bighorn sheep skeletal remains have been recovered from the monument and are being evaluated by the Museum of Southwestern Biology to determine which subspecies of bighorn was endemic to the El Malpais. (Preliminary analysis indicates that they are remains of Rocky Mountain bighorn.) The bighorn is an important species that is now missing in the monument. The NMDG&F has identified El Malpais National Monument and National Conservation Area as one of 10 areas in the state for possible reintroduction of bighorn sheep. Further studies are needed to determine if this is suitable habitat. If determined practicable, a bighorn sheep reintroduction program and associated management plan will be developed in consultation with NMDG&F, BLM, USFWS, and possibly local American Indian groups.

## PROPOSED MONUMENT BOUNDARY ADJUSTMENT

Boundary issues were examined as part of the planning process, as specified in section 604 of the National Parks and Recreation Act of 1978 (16 U.S.C. 1a-5 et seq.). Authority for modifying boundaries is contained in the Land Water Conservation Fund Act amendments of June 10, 1977 (Public Law 95-42). The following boundary



modification is proposed. It should be noted that this boundary adjustment is solely an administrative change between the national monument (the Park Service) and the national conservation area (the Bureau of Land Management).

The multiagency center site presently encompasses 1,089.70 acres (T 10 N, R 9 W, sections 6, 7, and 18). The Park Service has determined that the full 1,089.70 acres is unnecessary for development of the center. No advantages would be gained by placing the center farther south to justify the extra land and development costs. Also, the additional acreage is not needed to protect or enhance the viewshed from the center. A boundary adjustment is proposed whereby the multiagency center site would be reduced to about 481 acres (see Boundary Proposal map). The preferred alternative includes deleting the southern half of section 7 and the northern half of section 18 (now within the monument) and placing these 640 acres into the national conservation area. A 54-acre parcel of land just north of the monument and southeast of the site access road (currently within the national conservation area) will become part of the national monument.<sup>28</sup> This land is currently in single private ownership and is undeveloped except for fences and some vehicular ways. A 19-acre parcel of land in the northwestern part of section 7 and the southwestern part of section 6 (a National Guard Armory is proposed for that area) will become part of the national conservation area.

## STAFFING

Over the next 10 years visitation to El Malpais National Monument is expected to increase greatly. During this time the Park Service will acquire private lands and develop numerous new facilities. Public use of the monument's facilities, roads, and trails will require additional staff to ensure proper resource protection and visitor services.

At full implementation of the preferred alternative, total staffing would be 31.7 full-time equivalents (FTEs). Above the existing level of staffing, this will require an increase of 1.0 FTE in the Division of

Management and Administration, 7.3 FTEs in the Division of Visitor Services and Resource Management, and 2.0 FTEs in the Division of Maintenance. Table 2 summarizes the monument staff as proposed under the preferred alternative. Both existing (authorized) staff and the proposed additions are indicated in the table. A description of the work to be performed by the proposed staff is in appendix K.

Following acquisition of the **Bandera** Crater property, the private lands along NM 117, and the multiagency center site, reorganization of the monument will occur. It is proposed that two districts will be established to provide protection and visitor service on both sides of the monument. The east district staff, responsible for the multiagency center and the eastern part of the monument, will live in Grants and have office space in the leased headquarters building along with other personnel serving the whole monument. Most west district personnel, responsible for the **Bandera** visitor center and the western portion of the monument, will be required to occupy the residences near **Bandera** Crater.

## CARRYING CAPACITY

Carrying capacity is a concept for estimating the level of a particular use that a unit of land can support without resource degradation. As applied to outdoor recreation areas, carrying capacity is the maximum theoretical level of visitation that a parkland could support before natural, cultural, and experiential resources would begin to be damaged.

The general lack of baseline resource data about El Malpais National Monument makes it difficult to accurately determine the monument's carrying capacity. There is, however, enough data to conclude that adverse resource impacts will probably not occur. This conclusion is based on the low level of visitor use, actual and projected, and the intention behind the proposed development to contain visitors within nonsensitive areas. Because baseline data is lacking, a study will be conducted to determine the potential impacts of visitor use and the ability of the resources to withstand those

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28. See the El Malpais National Monument **Land Protection Plan** for more specific information on these boundary adjustments.

**TABLE 2: STAFFING REQUIREMENTS UNDER THE PREFERRED ALTERNATIVE (INCLUDING EXISTING STAFF)**

<b>POSITION</b>	<b>GRADE</b>	<b>SALARY (1989 \$)</b>	<b>FTE</b>
<b>DIVISION OF MANAGEMENT AND ADMINISTRATION</b>			
<u>Existing Authorized Staff</u>			
Superintendent*	GS-13	\$ 47,906	1.0
Administrative Officer	GS-09	29,456	1.0
Clerk Typist	GS-04	15,868	1.0
Clerk Typist (Seasonal)	GS-03	4 . 1 8 6	<u>.3</u>
Authorized Annual Total		\$97,416	3.3
<u>Proposed Additions to Staff</u>			
Purchasing Agent	GS-07	<b>\$25,654</b>	<u>1.0</u>
Total Increase		<b>\$25,654</b>	1.0
<b>Proposed Division Total</b>		<b>\$ 123,070</b>	4.3
<b>DIVISION OF VISITOR SERVICES AND RESOURCE MANAGEMENT</b>			
<u>Existing Authorized Staff</u>			
Chief Ranger*	GS-12	\$41,607	1.0
Supervisory Park Ranger	GS-11	33,630	1.0
Resource Management Specialist	GS-09	29,456	1.0
Park Ranger (Interpretive Specialist)*	GS-09	29,456	1.0
Supervisory Park Ranger	GS-09	29,456	1.0
Park Ranger (Area Ranger)	GS-07	25,654	1.0
Park Ranger (Protection and Backcountry)	GS-05	17,752	1.0
Park Ranger (Protection)	GS-05	17,752	1.0
Park Ranger (Interpretation)	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-05	10,651	0.6
Park Ranger (Seasonal)	GS-05	8,876	0.5
Park Ranger (Seasonal)	GS-04	7,505	0.5
Park Ranger (Seasonal)	GS-04	7,505	0.5
Park Ranger (Seasonal)	GS-04	7 . 5 0 5	<u>0.5</u>
Authorized Annual Total		\$284,557	11.6
<u>Proposed Additions to Staff</u>			
Resource Management Specialist (Fire/Veg.)	GS-07	23,455	1.0
Park Ranger (Interpretation)	GS-07	25,564	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-04	7,505	0.5
Dispatcher/Clerk	GS-04	15,868	1.0
Park Ranger (Seasonal)	GS-03	5,840	0.4
Park Ranger (Seasonal)	GS-03	5 . 8 4 0	<u>0.4</u>
Total Increase		\$137,328	7.3
<b>Proposed Division Total</b>		<b>\$421,885</b>	18.9

## DIVISION OF MAINTENANCE

### Existing Authorized Staff

Facility Manager*	<b>GS-09</b>	<b>\$29,456</b>	1.0
Maintenance Worker	WG-07	22,129	1.0
Work Leader	WL-07	<b>22,456</b>	1.0
Maintenance Worker	WG-05	19,422	1.0
Maintenance Worker	WG-05	19,422	1.0
Seasonal Laborer	WG-03	<b>7,760</b>	<b>0.5</b>
Seasonal Laborer	WG-03	<b>7,760</b>	<b>0.5</b>
Seasonal Laborer	WG-03	<u>7,760</u>	<u>0.5</u>

Authorized Annual Total		\$ 136,165	<b>6.5</b>
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### Proposed Additions to Staff

Maintenance Mechanic	WG-09	<b>22,874</b>	1.0
Maintenance Worker	WG-05	<u>19,422</u>	<u>1.0</u>

Total Increase		<b>\$42,296</b>	<b>2.0</b>
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<b>Proposed Division Total</b>		<b>\$178,461</b>	<b>8.5</b>
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<b>PROPOSED MONUMENTWIDE TOTAL</b>		<b>\$723,416</b>	<b>31.7</b>
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Total Increase Over Authorized Staff		<b>\$205,278</b>	10.3
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\* Indicates staff who will have support duties for the Masau Trail.

impacts. The study will include a component to examine how the level of recreation use affects the overall visitor experience. Monument staff can begin studying the effects of visitor use on resources by documenting, mapping, and photographing fragile resources and terrain conditions. This will assist in determining resource carrying capacity.

## **FUTURE PLANS AND STUDIES**

In addition to the plans and studies that have already been described, the following are needed and will be initiated under the preferred alternative.

### **Visitor Center Facility Plan**

The NPS Harpers Ferry Center will prepare facility plans concurrently with the preparation of the comprehensive design for the multiagency center and the **Bandera** visitor center. This will ensure that the buildings and their interpretive contents, such as exhibits and audiovisual media, are compatible, nonrepetitive, and functional and that they address the needs of mobility, sensory, and mentally impaired persons.

### **Monumentwide Sign Plan**

A sign plan will be prepared by the monument staff in consultation with the Bureau of Land Management to ensure a common appearance and format for signs used in both the monument and conservation area. Monument signs will be in conformance with NPS sign standards and will be compatible with the natural features of the area, yet easily visible from roads and trailheads. Sign messages will be clear, concise, and quickly understood. Regardless of the message conveyed, each sign will be recognized as an El Malpais National Monument/National Conservation Area sign. The sign plan will be prepared before the wayside exhibit plan described below so that exhibit planners can follow monument sign standards.

### **Wayside Exhibit Plan**

A wayside exhibit plan for both the monument and the conservation area will be prepared by the NPS Harpers Ferry Center in consultation with NPS and

BLM staff and regional and state offices. These entities will coordinate efforts to avoid a piecemeal approach to interpretation. Wayside exhibits and signs will be designed to create a visual similarity (continuity of design that can be easily identified by visitors) that will reinforce the fact that the national monument and national conservation area are both part of El Malpais.

## **Media Plans/Special Considerations**

A recurrent theme presentation at El Malpais centers on the world views of other cultures. All stages of media production for audiovisual products, indoor exhibits, wayside exhibits, and publications associated with this theme will be developed in consultation with tribal representatives. American Indian consultation on content will begin during the initial research.

## **Visitor Expenditure Patterns**

There is a need to understand the expenditure patterns of visitors to El Malpais National Monument. It is especially important to determine the impacts of these expenditures on surrounding communities. A generalized economic impact assessment methodology is currently under development for the National Park Service. The methodology is being tested at Great Basin National Park (Nevada), another recent addition to the national park system. The methodology includes generation of baseline data, prediction of impacts, and measurement of actual economic impacts over time and is intended to be applicable in other parks. Management should consider implementing an economic impact study using this methodology at El Malpais as soon as the monument becomes fully operational.

## **Carrying Capacity Study**

As noted in the section on carrying capacity, there is a need to initiate the collection of additional baseline resource and visitor use data as soon as possible. This data will allow management to more accurately assess the ability of resources to withstand impacts associated with visitor use.

## DEVELOPMENT PRIORITIES AND COSTS

The phasing and estimated costs of development are summarized below. These estimates are gross costs (construction cost plus project planning, construction supervision, and contingencies) and are in 1989 dollars. More detailed cost estimates are provided in appendix L. The general order of rationale for prioritizing developments as well as meeting other objectives for the monument is to

- meet legislative requirements for developing visitor services
- meet needs for public life, health, and safety
- consult with American Indians on matters of access, development, interpretation, and protection of resources
- promote the orderly phaseout of grazing by the end of 1997
- identify fragile and significant resources requiring special management
- create the necessary infrastructure for providing a full spectrum of visitor opportunity
- provide staff-related facilities to support resource and visitor protection
- cooperate with the Bureau of Land Management in taking the actions needed to manage both the national monument and conservation area

Development priorities for the 13 areas were developed by the planning team, with input by monument managers. The specific development actions at each area are shown in order of priority. However, some items may not be developed in the literal order shown in the entire list. Many factors, including land acquisition and availability of road and other construction funding, also affect the eventual order of development.

**TABLE 3: DEVELOPMENT PRIORITIES AND COSTS – PREFERRED ALTERNATIVE**

	<b><u>\$ fin thousands)</u></b>
<b>1. Bandera Crater Area</b>	
• adapt trading post complex for NPS visitor purposes	\$174
• upgrade trails to <b>Bandera</b> Crater, Ice Cave, and lava surface features, including wheelchair-accessibility features	232
• construct entrance and one-way tour road, visitor center, parking for visitor center and trading post, utility systems, and visitor center nature trail and parking	7,565
• construct maintenance and residential area roads, buildings, and utilities	<b>2,294</b>
• develop remaining trails (Spattercone Valley, Cerro <b>Bandera</b> , connectors, etc.)	334
• recontour and restore cinder and borrow pits to natural appearance	312
<b>2. Multiagency Center</b>	
• construct utilities, entry road, parking, and visitor center	3,347
• develop trail	32
<b>3. Dripping Lava Cave</b>	
• construct spur road/parking	381
• develop trail to cave, stairs, and trail inside cave	83
• develop trail to Lava Crater	17
<b>4. El Calderon</b>	
• close and revegetate south end of Bat Cave road; construct new gravel road to within 1/4 mi. of Bat Cave	321
• construct gravel parking, vault toilets, trailhead, and trails to Bat Cave, Double Sinks, and Junction Cave	118
• improve El Calderon Road for through-traffic to south	484
• close and revegetate Corral road	119
• designate viewing area for bat flights	
<b>5. Sandstone Bluffs/Las Ventanas</b>	
• pave Sandstone Bluffs road and redesign parking; construct vault toilets, provide lockable gate	2,157
• develop short wheelchair-accessible trail to overlook	14
• construct paved spur road to Las Ventanas parking/trailhead	130
• develop trail to natural arch and Las Ventanas sites	52
<b>6. East Rendija Trailhead/Cerro Bandera</b>	
• realign Route 42 (first 2.0 mi.) and upgrade route leading to East Rendija to a gravel standard; construct parking and vault toilets at East Rendija	1,958
• construct trailhead and trails to Big Skylight and Four-Window caves; mark primitive trails to Seven Bridges and Caterpillar collapses	66
• construct Cerro <b>Bandera</b> parking, trailhead, and trail to summit	71
• revegetate closed portion of previously used Route 42 (east of Cerro <b>Bandera</b> )	78
• construct gravel roadside parking, trailhead, and loop trail to lava wall	50
<b>7. The Narrows</b>	
• construct parking and short wheelchair-accessible trail	119
• mark trail onto <b>McCarty's</b> flow	22

<b>8. Zuni-Acoma Trail (west end)</b>	
• construct wheelchair-accessible parking spaces and trail to overlook	6
• rehabilitate gravel parking area and spur road	3
<b>9. Acoma-Zuni Trail (east end) (if easement acquired)</b>	
• construct paved parking area and trailhead	131
<b>10. McCartys Crater (option 1)</b>	
• construct spur road, parking, and trail to overlook	175
<b>11. East Rendija Campground</b>	
• construct spur road, campsites, vault toilets	416
<b>12. Braided Cave Trailhead</b>	
• install lockable gate	3
• formalize dirt parking area and trailhead at gate; develop trail to Braided Cave	39
<b>13. Roadside Kiosk Along NM 117</b>	
• construct structures and parking and install signs	<u>26</u>
<b>TOTAL (in thousands)</b>	<b>\$21,330</b>

## MINIMUM REQUIREMENTS ALTERNATIVE

As an alternative to the preferred alternative (the draft general management plan) this minimum requirements alternative contains the minimum feasible actions and development that would meet legislative mandates, alleviate health and safety concerns, and still provide essential protection for the cultural and natural resources of El Malpais National Monument. Fewer interesting features of the monument would be available for public use under the minimum requirements alternative, and in general, access would not be as improved as under the preferred alternative. It should be noted that this alternative, although meeting legislative requirements, is otherwise close to the existing conditions of the monument and thereby also serves as the “no-action” alternative for the environmental assessment. (A true no-action alternative -which would mean a continuation of all existing conditions and no proposals for developing the two visitor centers as required by law – is not a feasible or viable alternative for El Malpais National Monument.) The details of this alternative are shown on the following General Development – Minimum Requirements Alternative map. A table later in this section compares various aspects of the preferred and minimum requirements alternatives.

### VISITOR FACILITIES/DEVELOPMENT

#### Administrative Headquarters

Under this alternative, plans for monument administrative headquarters would be the same as for the preferred alternative.

#### Multiagency Center

Under the minimum requirements alternative, the multiagency center near Grants would be the same as under the preferred alternative.

#### Bandera Crater Area

Although the new Bandera visitor center and its paved parking area would be in a different location under this alternative – slightly east of the existing trading post<sup>28</sup> (see Bandera Crater Area DCP – Minimum Requirements Alternative) -the facility and most of its functions would be the same as under the preferred alternative. Consideration would also be given to the impacts of the Zuni Railroad if that project is initiated, as described under the preferred alternative.

The existing road leading south toward the trading post from NM 53 would be paved. However, the southern end of the improved road would be realigned toward the east to set the visitor center and its parking area apart from the trading post and reduce visual impact of modern development on this historic scene. (There would be no one-way tour road as under the preferred alternative.)

The existing trading post complex would be adaptively reused as described under the preferred alternative. At least part of the cinder parking lot would be retained; the parking area would be at least the same size as under the preferred alternative. There would be no picnic tables in the Bandera area because of space limitations.

The existing trail to the ice Cave would be improved and would be interpreted and made wheelchair-accessible; a new wheelchair-accessible trail to the nearby lava surface features would also be built, as under the preferred alternative. The existing trail to Bandera Crater would be interpreted. This trail would also be brought up to safety standards. (Most of these trails would be on an existing unused motor route.) The stairway to the Ice Cave would also be replaced, and a viewing platform for handicapped visitors would be installed as described under the preferred alternative.

Access to Dripping Lava Cave would be provided by a primitive trail from the trading post area, and stone steps would be provided into the cave. There

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28. Careful design and choice of site will ensure easy visitor access while preserving the historic character of the adjacent trading post complex.

would be no trail to Lava Crater and no interconnecting new trails to Sandstone Ridge, Spattercone Valley, or other lava surface features.

The four single-family residences, four-unit apartment building, and four-bay maintenance building would be the same as described under the preferred alternative.

### **East Rendija Area**

There would be no improvement to or realignment of the existing access from NM 53 to the East Rendija area. Better county maintenance along existing Route 42 would be encouraged. Parking at the trailhead would remain informal (along the roadside), and there would be no campground or vault toilets. The Cerro Bandera summit and lava wall trails would not be built. Vehicular access to East Rendija would remain primitive, with passage only for high-clearance vehicles during dry conditions.

### **Braided Cave**

Access to Braided Cave area would be on existing high-clearance roads. Parking would be informal, as existing, and there would be no marked route to Braided Cave.

### **El Calderon Area**

Access from NM 53 and parking for Junction and Bat caves would be on the existing high-clearance road, and there would be no improvements to the El Calderon road or changes in use of the Corral road. Parking would be informal, along the roadside.

There would be no trails to Bat Cave or Double Sinks. Junction Cave would not be marked for public use. The east tube of Bat Cave would be closed for visitor health and safety reasons and to protect the bats; however, bat viewing would be allowed from a safe distance as described under the preferred alternative. Exploration of the west tube of Bat Cave would not be encouraged.

### **Zuni-Acoma/Acoma Zuni Trail**

The west end access road, parking, and short gravel trail to the initial viewpoint would remain as existing.

The east end access road and parking would be as described under the preferred alternative.

### **Las Ventanas**

At Las Ventanas, no trails or other formal means of access would be provided. As described below, there would be a gate on the Sandstone Bluffs road at NM 117 that would be closed at night.

### **Sandstone Bluffs Overlook**

The access road to Sandstone Bluffs from NM 117 would remain gravel surfaced under this alternative, although one short segment would be realigned for safety. The parking area would be redesigned but not paved, and vault toilets would not be provided (toilet facilities would be available on the east side of NM 117 at the BLM visitor contact station). A wheelchair-accessible trail would be built to one overlook, and a lockable gate at NM 117 would be closed at night to improve resource protection of the Sandstone Bluffs and Las Ventanas areas, as described under the preferred alternative.

### **The Narrows**

There would be no development at the Narrows under the minimum requirements alternative, and therefore no opportunity for visitors to see at close range the surface features of the McCartys flow.

### **McCartys Crater Viewpoint**

There would be no development at this location.

### **Roadside Kiosk along NM 117**

The kiosk would be as described under the preferred alternative.

## BANDERA CRATER VISITOR CENTER

- BUILD NEW HANDICAP-ACCESSIBLE VISITOR CENTER EAST OF TRAIL, POST PAVE; SLIGHTLY REALIGN ACCESS FROM NM 53, PAVE PARKING
- REHABILITATE AND ADAPTIVELY USE CONTRIBUTING HISTORIC STRUCTURES, REMOVE NONCONTRIBUTING STRUCTURES
- MAINTAIN PRIMITIVE ACCESS TO TRIPPLING, LAVA CAVE
- DEVELOP UTILITY SYSTEM FOR VISITOR CENTER, MAINTENANCE/RESIDENCE AREAS; TRADING POST
- MAKE TRAILS TO ICE CAVE; LAVA SURFACE FEATURES WHEELCHAIR ACCESSIBLE, PROVIDE NEW STAIRS; CHAIRLIFT AT ICE CAVE

## NPS RESIDENCE; MAINTENANCE AREAS

- CONSTRUCT PAVED ACCESS FROM NM 53, PAVED PARKING
- BUILD 4 RESIDENCES, ONE 4-UNIT APARTMENT BUILDING
- BUILD 4-BAY MAINTENANCE BUILDING
- DEVELOP UTILITY SYSTEM

## EL CALDERON AREA

- USE EXISTING ACCESS TO BAT CAVE
- CLOSE EAST SIDE OF BAT CAVE, BUT ALLOW VIEWING OF FLIGHTS

## ZUNI-ACOMA TRAIL

- USE EXISTING ACCESS; TRAIL TO OVERLOOK

## MULTI-AGENCY VISITOR CENTER

- CONSTRUCT PAVED ACCESS FROM EAST I-40 INTERCHANGE
- CONSTRUCT HANDICAP-ACCESSIBLE ORIENTATION/INFORMATION CENTER; PAVED PARKING
- DEVELOP SHORT TRAIL

## RATLER STATION (BLM)

- BUILD STATION, PAVED ACCESS, PARKING, RESIDENCE
- DEVELOP INTERPRETIVE TRAIL

## SANDSTONE BLUFFS

- REALIGN EXISTING GRAVEL ACCESS
- REDESIGN EXISTING GRAVEL PARKING, PROVIDE WHEELCHAIR-ACCESSIBLE TRAIL TO OVERLOOK
- INSTALL LOCKABLE GATE FOR OVERNIGHT CLOSURE NEAR NM 117

## ACOMA-ZUNI TRAIL

- CONSTRUCT PAVED ROADSIDE PARKING; TRAILHEAD IF EASEMENT ACQUIRED

## LA VENTANA (BLM)

- CONSTRUCT GRAVEL PARKING AREA, DEVELOP TRAILHEAD; LOOP TRAIL TO ARCH (WHEELCHAIR-ACCESSIBLE STAIR TO VIEWPOINT)
- PROVIDE VAULT TOILETS

## SOUTH BK NARROWS (BLM)

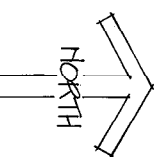
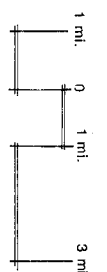
- REDESIGN GRAVEL ACCESS; PARKING
- PROVIDE PUBLIC AREA
- DEVELOP TRAILHEAD FOR CEBOLLA WILDERNESS

## NM 117 ROADSIDE KIOSK (SOUTH)

- DEVELOP PAVED ROADSIDE PARKING
- CONSTRUCT ORIENTATION/INFORMATION KIOSK

## LEGEND

- NATIONAL MONUMENT BOUNDARY (NPS)
- NATIONAL CONSERVATION AREA BOUNDARY (BLM)

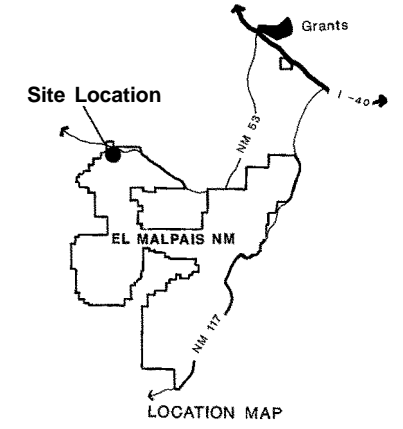
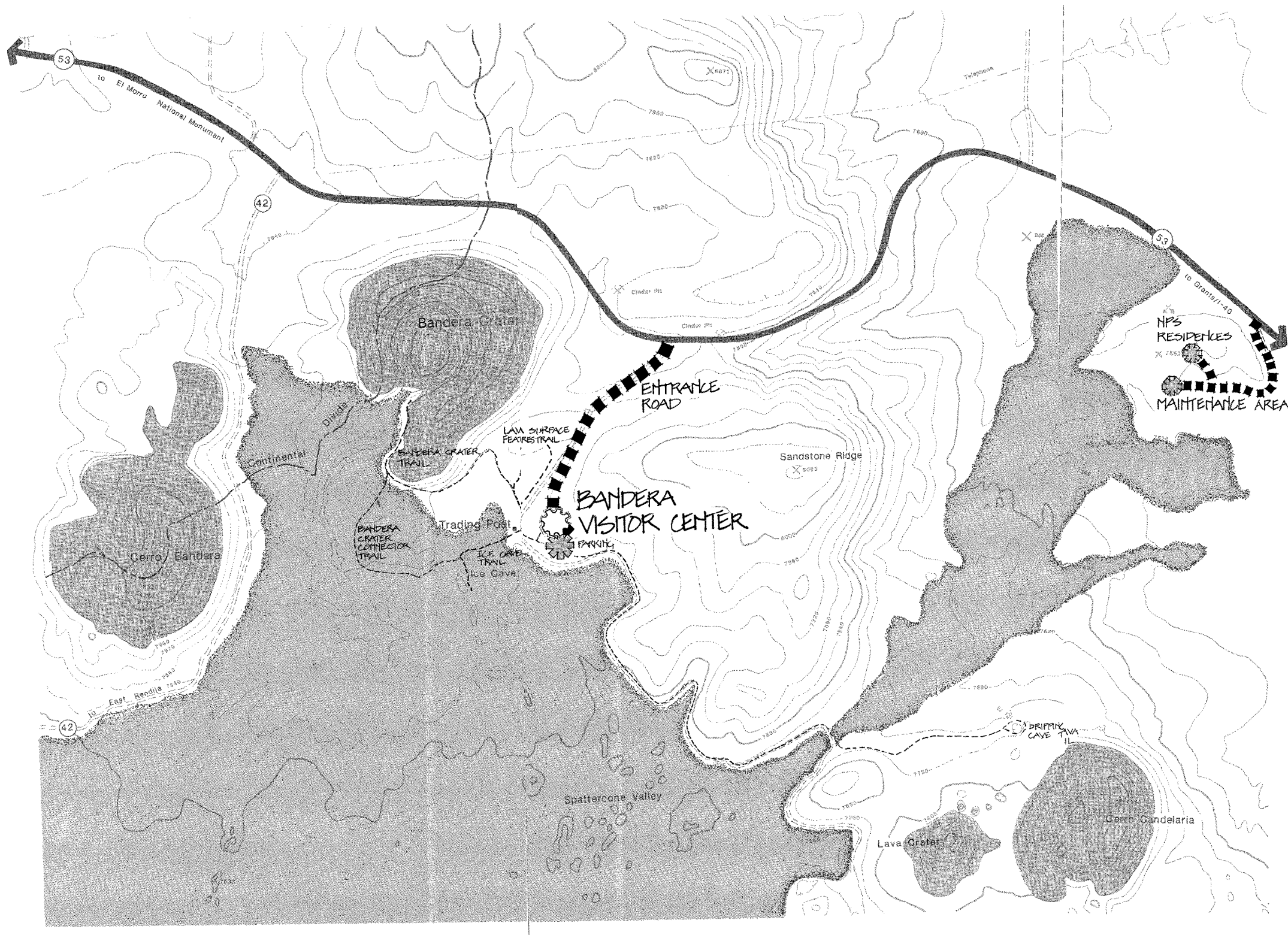


## GENERAL DEVELOPMENT

### MINIMUM REQUIREMENTS ALTERNATIVE

### EL MALPAIS NATIONAL MONUMENT

### U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE



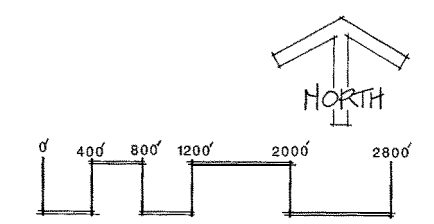
# BANDERA CRATER AREA DCP

## (MINIMUM REQUIREMENTS ALTERNATIVE)

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE  
DSC/JULY 1989/103/20,011

- LEGEND**
- PROPOSED PAVED ROAD \*
  - PROPOSED NEW TRAIL OR UPGRADE \*
  - EXISTING DIRT ROAD

\* ROAD, PARKING, TRAIL ALIGNMENTS ARE APPROXIMATE. ACTUAL ALIGNMENTS TO BE DETERMINED.



## VISITOR SERVICES/INTERPRETATION

The areas with the same development as proposed under the preferred alternative and the Sandstone Bluffs overlook would have the same plan for visitor services and interpretation. The visitor services and interpretation specifically related to viewing the bats at Bat Cave would also be provided under the minimum requirements alternative.<sup>29</sup> For areas where development is not proposed under the minimum requirements alternative, the visitor services/interpretation plan described under the preferred alternative would not apply. Although the Bandera visitor center would be in a different location and there would be fewer trails in the Bandera area under the minimum requirements alternative, the visitor services and interpretation plan for those facilities and trails would be basically as described under the preferred alternative.

Facilities for special populations would be the same as under the preferred alternative with the exception of the Narrows, which would have no development, and visitors in wheelchairs would not have the opportunity to see lava features in this area.

Recreational activities in the areas proposed for development under the minimum requirements alternative would be basically the same as under the preferred alternative. However, because there is less overall development proposed, fewer recreational activities would be available under the minimum requirements alternative. Frontcountry sight-seeing would be focused at the Bandera Crater and Sandstone Bluffs areas. There would be fewer trails in the Bandera area, and therefore fewer recreational activities.

## CULTURAL RESOURCES MANAGEMENT

There are no significant differences between the preferred and minimum requirements alternative regarding the treatment of cultural resources. Cultural resource identification, documentation, evaluation, protection, interpretation, management,

and collections management/curation are keyed to a basic level and type of cultural resource management as defined by law and NPS policies.

With less development under the minimum requirements alternative, fewer sites would be disturbed (i.e., less impact); however, the intensity of survey and protection would be the same as under the preferred alternative – except there would be no mitigation necessary for removing backfill and stabilizing the tower kiva at Las Ventanas as proposed under option 2 of the preferred alternative, and there would be no historic structures report for Las Ventanas under the minimum requirements alternative.

The minor differences between the two alternatives derive primarily from the location, scope, and timing of development. As under the preferred alternative, areas to be developed or that have serious threats to cultural resources would require documentation and evaluation sooner than the rest of the monument.

Also, under the minimum requirements alternative, there would be less staff available for resource protection.

## NATURAL RESOURCES MANAGEMENT

There would be no significant difference in the plan for natural resources management under the minimum requirements alternative, although with less development fewer sites and resources would be disturbed -which means fewer impacts. The proposed management is a basic level that is required by legislative mandates and NPS policy. However, less staff would be available for resource protection under the minimum requirements alternative.

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29. These areas include Dripping Lava Cave, Lava Crater, Cerro Bandera, Spattercone Valley, Sandstone Ridge, East Rendija (including Big Skylight and Four-Windows caves and Caterpillar and Seven Bridges collapses), Braided Cave, El Calderon (including Double Sinks and Junction Cave), the Zuni-Acoma Trail (west end), Las Ventanas, the Narrows, and McCartys Crater viewpoint.

## PROPOSED MONUMENT BOUNDARY ADJUSTMENT

The boundary adjustment proposed for the multiagency center would be the same as under the preferred alternative.

## STAFFING

The additional staff proposed under this alternative would be the minimum level necessary for visitor services and resource protection. This alternative would require that 3.7 full-time equivalent (FTE) positions be added to the monument's authorized staff. Total staffing would then be 16 FTEs. Table 4 summarizes the staffing in the minimum requirements alternative. Both existing (authorized) staff and the proposed additions are shown in the table.

## CARRYING CAPACITY

The carrying capacity under the minimum requirements alternative would be the same as described under the preferred alternative.

## FUTURE PLANS AND STUDIES

The plans and studies proposed under the preferred alternative would also be initiated under the minimum requirements alternative.

## DEVELOPMENT PRIORITIES AND COSTS

The phasing and estimated costs of development under the minimum requirements alternative are summarized in table 5. These estimates are gross costs (construction cost plus project planning, construction supervision, and contingencies) and are in 1989 dollars. The general rationale for prioritizing developments as well as meeting other objectives for the monument is the same as under the preferred alternative. The specific development actions under each area are not necessarily shown in order of priority.

TABLE 4: STAFFING REQUIREMENTS: MINIMUM REQUIREMENTS ALTERNATIVE

POSITION	GRADE	SALARY (1989 \$)	FTE
<b>DIVISION OF MANAGEMENT AND ADMINISTRATION</b>			
<u>Existing Authorized Staff</u>			
Superintendent	GS-12	\$41,607	1.0
Administrative Technician	<b>GS-07</b>	<b>21,669</b>	1.0
Clerk Typist	<b>GS-03</b>	<b>15,868</b>	<b>1.0</b>
Authorized Annual Total		\$79,144	<b>3.0</b>
<u>Proposed Additions to Staff</u>			
None			
<b>Proposed Division Total</b>		<b>\$79,144</b>	<b>3.0</b>

## DIVISION OF VISITOR SERVICES AND RESOURCE MANAGEMENT

### Existina Authorized Staff

Chief Ranger	GS-11	\$33,630	<b>1.0</b>
Resource Management Specialist	GS-09	29,456	<b>1.0</b>
Park Ranger (Interpretation)	GS-07	23,455	<b>1.0</b>
Park Ranger (Protection)	GS-07	25,654	<b>1.0</b>
Park Ranger (General)	GS-05	17,752	<b>1.0</b>
Park Ranger (Seasonal)	GS-04	4,503	0.3
Park Ranger (Seasonal)	GS-04	4,503	0.3
Park Ranger (Seasonal)	GS-04	<u>3,001</u>	0.2
Authorized Annual Total		\$141,954	5.8

### Proposed Additions to Staff

Park Ranger (Interpretation)	GS-05	\$ 17,752	1.0
Park Ranger (interpretation)*	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-04	6,002	0.4
Park Ranger (Seasonal)	GS-04	<u>4,503</u>	<b>0.3</b>
Total Increase		<b>\$46,009</b>	2.7
Proposed Division Total		<b>5187.963</b>	8.5

## DIVISION OF MAINTENANCE

### Existina Authorized Staff

Maintenance Foreman	WS-08	\$ 27,286	1.0
Maintenance Worker	WG-07	22,129	1.0
Maintenance Worker	WG-05	19,422	1.0
Maintenance Worker (Seasonal)	WG-03	<u>7,760</u>	<b>0.5</b>
Authorized Annual Total		\$76,597	3.5

### Proposed Additions to Staff

Maintenance Worker (Seasonal)	WG-05	\$ 9,186	0.5
Maintenance Worker (Seasonal)	WG-03	<u>7,760</u>	<b>0.5</b>
Total Increase		\$ 16,946	1.0
<b>Proposed Division Total</b>		<b>\$93.543</b>	4.5

<b>PROPOSED MONUMENTWIDE TOTAL</b>		<b>\$360,650</b>	<b>16.0</b>
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Total Increase Over Authorized Staff		<b>\$62,955</b>	3.7
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\* Indicates staff who will have support duties for the Masau Trail

**TABLE 5: DEVELOPMENT COSTS – MINIMUM REQUIREMENTS ALTERNATIVE**

	<b><u>\$(in thousands)</u></b>
<b>1. Bandera Crater Area</b>	
• adapt trading post complex for NPS visitor purposes	117
• upgrade trails to Bandera Crater, Ice Cave, and lava surface features, including handicap-accessible features	249
• realign and pave existing access road, build visitor center and parking, provide parking for trading post, develop utility system, remove noncontributing structures, improve intersections, obliterate and revegetate road, landscaping	4,736
• construct maintenance and residential area roads, buildings, and utilities	2,266
• recontour and restore cinder and borrow pits to natural appearance	312
• develop primitive trail to Dripping Lava Cave	6
<b>2. Muiltiagency Center</b>	
• construct utilities, entry road, parking, and visitor center	3,347
• construct trail	32
<b>3. El Calderon</b>	
• designate viewing area for bat flights	1
<b>4. Sandstone Bluffs/Las Ventanas</b>	
• realign gravel road and redesign parking; provide lockable gate	62
• construct short wheelchair-accessible ramp and trail to overlook	27
<b>5. Acoma-Zuni Trail (east end) (if easement acquired)</b>	
• paved spur road, parking, connecting trail, signs, intersection improvement, and landscaping	131
<b>6. Roadside Kiosk Along NM 117</b>	
• structure, parking, and signs	<u>26</u>
<b>TOTAL (in thousands)</b>	<b>\$11,314</b>

## COMPARISON OF ALTERNATIVES

The following table compares the preferred alternative and the minimum requirements alternative regarding development.

**TABLE 6: SUMMARY COMPARISON OF DEVELOPMENT**

<u>PREFERRED ALTERNATIVE</u>	<u>MINIMUM REQUIREMENTS ALTERNATIVE</u>
<b>Multiagency Center, Grants</b>	<b>Multiagency Center, Grants</b>
Construct handicap-accessible orientation/information center for travelers; develop short trail	Same as preferred
Construct paved access road from I-40	Same as preferred
Construct paved parking area	Same as preferred
<b>Bandera Crater/Lava Crater Area</b>	<b>Bandera Crater/Lava Crater Area</b>
Construct new handicap-accessible visitor center east of Sandstone Ridge with paved parking area	Construct new handicap-accessible visitor center east of existing trading post with paved parking area; size of facility and functions would be same as under preferred alternative
Construct new paved two-way access from NM 53 to new visitor center; continue road as one-way paved tour road to new parking area near trading post and an exit onto NM 53, which will be partially realigned	Pave existing two-way road from NM 53; slight realignment eastward at southern end
Adaptively reuse trading post; two of the cabins reused as restrooms and one will be restored as early tourist cabin; remove noncontributing structures; maintain rails and part of existing cinder parking lot	Same as preferred except no cabins would be used as restrooms
Construct new paved two-way spur road to Dripping Lava Cave/Lava Crater trailhead; develop trails to Dripping Lava Cave and Lava Crater	Provide trail to Dripping Lava Cave from trading post area
Develop interconnecting trails to Sandstone Ridge, Spattercone Valley, Cerro Bandera, and other lava features	No new trails
Interpret and make trail to Ice Cave wheelchair-accessible; develop wheelchair-accessible trail to nearby lava surface features interpret Bandera Crater trail	Same as preferred
Provide picnic tables near trading post, at least one wheelchair-accessible	No picnic tables in Bandera area

#### PREFERRED ALTERNATIVE

##### **Bandera Area (cont.)**

Construct four single-family residences, four-unit apartment, four-bay maintenance building, access road, parking, and utilities east of new visitor center

Recontour and restore cinder and borrow pits

##### **East Rendija Area**

Develop new trailhead and trail to top of Cerro Bandera (from spur off East Rendija road)

Gravel 6-mile access, with realignment of first 2 miles; elevate road; close and restore first 2 miles of existing road

Construct six-site (expandable to meet demand) primitive campground; no water

Develop parking area and short interpretive trail to lava wall

Formalize and gravel parking at East Rendija; develop new trailhead

Provide vault toilets at campground and trailhead

Develop trails to Big Skylight and Four-Windows caves; mark route to Seven Bridges and Caterpillar collapses

##### **Braided Cave**

Gate existing access road, and provide unimproved dirt parking area nearby

Mark route to Braided Cave

##### **El Calderon Area**

Gravel existing road to Junction Cave; construct new gravel road to new gravel parking .3 mi from Bat Cave; provide vault toilets

Develop trails to Bat Cave and Double Sinks from parking area, short trail to Junction Cave, and trail between Junction Cave and Double Sinks

Close east tube of Bat Cave but allow viewing of flights; west tube exploration not encouraged

Close Corral Road when necessary improvements are made on El Calderon road for through traffic; restore Corral Road when closed

#### MINIMUM REQUIREMENTS ALTERNATIVE

##### **Bandera Area (cont.)**

Same as preferred

Same as preferred

##### **East Rendija Area**

No trail to Cerro Bandera

No improvements to road; encourage better maintenance by county

No campground

No parking or trail

No parking or trailhead

No toilets

No trails

##### **Braided Cave**

Existing access; no gate

No trail

##### **El Caideron Area**

Existing primitive access to Bat Cave

No constructed trails to Bat Cave or Double Sinks, no trail between Double Sinks and Junction Cave, and Junction Cave unmarked

Same as preferred

No change to existing roads

**PREFERRED ALTERNATIVE****Zuni-Acoma/Acoma-Zuni Trail**

Use existing gravel road on west end; redesign existing parking; make trail to viewpoint wheelchair-accessible

If possible, acquire easement on east end and provide paved roadside parking and trailhead

**Las Ventanas****Option 1**

Construct new paved spur road and paved parking area off Sandstone Bluffs road

Develop trailhead and trail south along ridge to include natural arch, viewpoints, roomblock, tower kiva and great kiva (unexcavated but interpreted with waysides), and prehistoric road

Close Las Ventanas/Sandstone Bluffs road at night

**Option 2**

Same as option 1 except remove backfill and stabilize the tower kiva

**Sandstone Bluffs Overlook**

Realign and pave existing road; redesign and pave existing parking area; provide wheelchair-accessible vault toilets near parking

Develop wheelchair-accessible trail to overlook

Install lockable gate near NM 117

**The Narrows**

Provide roadside parking area for about six vehicles

Develop short wheelchair-accessible trail onto adjacent lava; mark trail to additional features

**McCartys Crater Viewpoint****Option 1**

Construct paved spur road, paved parking and trailhead; develop trail to viewpoint

**Option 2**

No development

**Roadside Kiosk along NM 117**

If option 2 for McCartys Crater viewpoint is chosen, construct orientation/information kiosk with paved parking along NM 117 at south entrance to monument/conservation area

**MINIMUM REQUIREMENTS ALTERNATIVE****Zuni-Acoma/Acoma-Zuni Trail**

Existing access and trail

Same as preferred

**Las Ventanas**

No access road and parking

No trails

Same as preferred

**Sandstone Bluffs Overlook**

Realign existing gravel access; redesign gravel parking area; no toilets

Same as preferred

Same as preferred

**The Narrows**

No development

**McCartys Crater Viewpoint**

No development

**Roadside Kiosk along NM 117**

Same as preferred

## OPTIONS CONSIDERED BUT REJECTED

Early in the planning process, several sites were studied for development and possible visitor use but were found unsuitable and dismissed from further consideration; some of these sites were rejected because they are places that are sacred to the American Indians. These sites are not identified in the following discussion out of consideration for their continued protection.

### MULTIAGENCY CENTER

The option of building the center in town was rejected because of legislative intent for the center to be built on the monument tract south of I-40.

### BANDERACRATER AREA

Consideration was given to a trail up to and along the rim of Bandera Crater; this was rejected because some visitors would deliberately slide down the fragile cinder slopes, resulting in unsightly damage to the resource and a possible safety hazard. The trail to the summit of Cerro Bandera was proposed as a substitute for a trail to the top of Bandera Crater.

It was decided not to establish a formal picnic area in the Bandera area because picnicking was not determined a primary function in this area. Because many people picnic from their cars, tables should be close to parking areas and not necessarily in formalized areas.

### COUNTY ROUTE 42

The option of paving the road to East Rendija from NM 53 was rejected because it would be very costly and few visitors are currently attracted to this area; the visitors who are currently attracted are interested in a primitive experience. Most visitors to the monument and conservation area will probably enter and leave from I-40 on the north and use NM 53 and NM 117 for access to most of the outstanding features of El Malpais. If large numbers of visitors were attracted to this part of Route 42 and the East Rendija area, a much higher level of staffing and development would be necessary.

### EAST RENDIJA AREA

The option of closing the access road and having visitors walk to East Rendija from Route 42 was rejected because there is existing use and at least low-standard vehicular access to East Rendija is needed because of the importance of the resources there.

### EL CALDERON AREA

The option of prohibiting the viewing of the bat flights was rejected because the public has been doing this for many years and viewing in itself is probably not harmful to bat ecology (as long as it is done at a reasonable distance). Consideration was given to encouraging use in the west tube of the cave, where there are few bats living, but this was rejected because of potential disturbance to the adjacent occupied cave. If visitors are allowed to go into the west tube, it does not seem likely that all people would stay out of the east tube, which is critical for the welfare of both the bats and the public. (Many visitors do not know that histoplasmosis can be contracted from breathing the air around bat guano.) It was also felt that nearby Junction Cave was a better opportunity to see a large cave in this area. The most logical answer seemed to be closing the west tube, allowing controlled viewing of the bat flights on the east tube from a safe distance, and making sure that visitors are aware of the possible health risks associated with a bat cave; these are the elements included in the preferred alternative for Bat Cave.

A trail around the rim of El Calderon was rejected because the view (looking out over private development in the national conservation area and a cinder pit on the side of the crater) would deter from visitor enjoyment. Also, plant life on the rim is fragile.

A metal scaffold with steps into the Double Sinks was considered. This was rejected because of the unknown impact on the resource (including ferns), the high cost for a viewing opportunity for a limited number of visitors, and the impact the stairs themselves would have on the view within the sinks.

## **ZUNI-ACOMA TRAILHEAD (WEST END)**

The option of relocating the parking area to an entirely new area was rejected because it was not cost-effective, opportunities for interpreting the local scene to handicapped visitors would be lost, and there would be unnecessary disturbance of additional terrain.

## **LAS VENTANAS**

Reconciling the apparent inconsistency between legislative intent for public enjoyment of Las Ventanas and protection of American Indian interests in the area was a particular challenge. Although Las Ventanas is one of the resources specifically mentioned as a reason for establishing the monument, the legislation also directs that consideration be given to American Indians for access to sites for traditional cultural and religious purposes. Las Ventanas has special significance to the Acoma Indians.

Not developing the site at all, even by trail, was considered; however, the site was one of the reasons for establishing the monument and it should have at least some minimal accessibility for visitors. Excavating the entire site, stabilizing it, and making it a “showcase” was also considered – but rejected because of the site’s significance to the Acoma. The preferred alternative is a compromise between these two extremes.

Paved or gravel access to the Las Ventanas site on a new road from NM 117 was also considered but rejected because it offers little resource protection and no control over access to the site. Also, a new road would disturb an area with high potential for archeological sites.

## **SANDSTONE BLUFFS OVERLOOK**

Consideration was given to a trail to the bottom of Sandstone Bluffs and the lava edge below the overlook. This option was rejected for two reasons: the trails could be seen from Sandstone Bluffs overlook and would detract from the view, and there is also the possibility that people would inadvertently trespass on nearby Acoma land.

Consideration was also given to interpreting the building foundation next to the Sandstone Bluffs

road. The structure may not be historic, and interpretation of the structure is probably not significant to the El Malpais story.

## **SOUTH BIG NARROWS**

This area was considered for a trail onto the lava. It was rejected because of the fragile biological resources in the area, its high potential as a resource natural area, and the lack of controllable access.

## NATURAL RESOURCES

### GEOGRAPHIC SETTING

El Malpais National Monument is in northwestern New Mexico and entirely within Cibola County. The monument lies between the Zuni Mountains on the west and the Cebollita Mesa highlands on the east. This area of 114,992 acres lies between state highways NM 117 and NM 53 south of the city of Grants. Elevations range from about 6,550 feet near the site of the proposed multiagency center to 8,372 feet at the summit of Cerro Bandera.

Approximately 95 percent of the monument is covered by lava flows. Named by early Spanish explorers, “El Malpais” means “the badlands” or “the bad country” and appropriately describes the dark volcanic landscape. The surfaces of the flows are rugged and contain a variety of plant and animal species. Density of the vegetation depends primarily on the age and surface characteristics of the lava. Soil is better developed on the older flows, and usually there is more vegetation there. The flows contain “kipukas” – outcrops of older rock surrounded by later lava flows. Many kipukas are relatively small, less than 5 acres; the largest, Hole-in-the-Wall, is more than 6,000 acres.

Outstanding volcanic features include cinder cones and other craters, spattercones, pressure ridges, and some of the most extensive lava tubes in the United States. (Refer to appendix M for definitions of common lava flow features.) Other outstanding features include light-colored sedimentary rock outcrops that contrast sharply with the dark lava. These include Mesita Blanca, an almost white limestone outcrop; La Vieja, a large sandstone pinnacle known for its “old woman” face-like feature; and the Sandstone Bluffs, part of the sandstone and rimrock country that stands above the eastern margin of the El Malpais lava flows.

The monument is bordered and largely surrounded by the 261,800-acre El Malpais National Conservation Area, which is administered by the Bureau of Land Management. The conservation area contains the Cebolla Wilderness Area (60,000 acres), the West Malpais Wilderness Area (38,210 acres), and the Chain of Craters Wilderness Study Area (17,468 acres). A small portion of the northern monument boundary adjoins the Cibola National

Forest, Mount Taylor District. The eastern boundary of the monument borders some of the lands owned by the Acoma Indians.

### CLIMATE

The monument is semiarid, with average annual precipitation estimated at about 10 inches. Most precipitation falls between July and September in the form of convective afternoon thundershowers. Snow is retained on north- and east-facing slopes during subfreezing periods from December through February. Prevailing winds are from the west and south.

### GEOLOGY

#### introduction to the Monument and Its Geology

El Malpais National Monument is nationally significant because of the lava flows that cover fully 95 percent of its surface. The legislation that authorized the monument refers to the “Grants Lava Flow,” which is understood to mean the numerous flows of the past million years that cover most of the monument and not just the flows that literally reached the Grants area. The flows and associated craters and cinder cones are an important scientific resource and strongly shape the direction of planning for El Malpais. Several of the younger flows have surface features that convincingly demonstrate the dynamics of fluid lava, and they contain long systems of subterranean tubes along their centers. This combination of surface features and lava tubes comprises one of the most interesting volcanic terrains on the continent.

The earliest flows and associated craters, in order of eruption, are at Cerro Encierro, Cerro Bandera and Cerro Rendija (see the Existing Conditions map). These flows, now eroded and obscured by vegetation, cover areas in the western half of the monument. The terrain covered by these earlier flows did not contain major valleys, and none of these flows extended as far east as McCarty's Valley (as did later flows).

Later flows and associated craters, which include the most recent eruptions in the monument, occurred in the following order: El Calderon and Lava Crater; Cerro Candelaria, Twin Crater and Lost Woman Crater; Hoya de Cibola (including the Braided Cave flow); Bandera Crater; and McCartys Crater. The flows from El Calderon, Lava Crater, Cerro Candelaria, and Hoya de Cibola are old enough to exhibit some erosion and well-developed vegetation compared to the rugged and barren volcanic landscapes of the two most recent flows that began at Bandera and McCartys craters. The later flows (described in this paragraph) differed from the earliest group of flows in that they flowed long distances from their sources in the northwestern part of the monument, first to the east and then north down McCartys Valley toward Grants.<sup>30</sup> Hikers who cross McCartys Valley on the Zuni-Acoma Trail see portions four of the five youngest flows of El Malpais National Monument. The geologic map by Maxwell (Geological Survey 1986) shows the distribution of all the rock formations, including lava flows of the El Malpais region.

The Bandera and McCartys flows, the most recent in the national monument, offer great potential for interpreting the detailed forms and textures of lava to the public. Portions of these flows are so close to main roads that access and development can be planned to show most of these features to visitors. Features of the Bandera flow in more remote areas can be seen by driving lower standard roads and by hiking, as proposed in the preferred alternative. (Features that will be seen by and interpreted to monument visitors are described later in this section.)

## Geographic and Tectonic Setting

El Malpais National Monument is at the southeastern edge of the Colorado Plateau, a large geographic province that covers more than 150,000 square miles in northwestern New Mexico, northern Arizona, southeastern Utah, and southwestern Colorado. The monument is in the Datil section of the plateau, which is extensively covered by lava rock (Geological Survey, Hunt 1956).

The monument is dominated by two major features: on the northwest by the Zuni uplift and on the east by benches and high mesas (culminating in the lava-capped Cebollita Mesa of the Acoma Reservation). McCartys Valley and its geographic extension to the south – North Plains – is a long, north-south physiographic “low” occupied by a major fault zone along the floor of the valley (Geological Survey, Maxwell 1986). This fault zone, with its west side down, seems to account for the valley and plain topography covered by the numerous young lava flows that comprise most of the national monument.

The Continental Divide lies mostly west of the national monument along the Chain of Craters, a long line of cinder cone volcanoes in the western part of the national conservation area. However, the extreme northwestern corner of the national monument does contain about 3 miles of the divide where it follows the rims of Cerro Bandera and adjacent Bandera Crater.

Most of the national monument is on the Atlantic side of the Continental Divide, where the drainage is eastward around the south end of the Zuni uplift and then northward along McCartys Valley into the Rio San Juan near Grants. The Rio San Juan flows eastward to join the Rio Puerco (which finally enters the Rio Grande). Within most of the monument, the drainage is “confused” because most precipitation falls on lava flows or on volcanic cinder that are either cavernous or porous; stream channels in this volcanic terrain are the exception rather than the rule. Much water is diverted to the subsurface and eventually emerges downvalley, miles from its source, as springs in small marshes along the Rio San Juan. Low points below the general surfaces of the lava flows, such as caves and “sinks,” contain seeps and springs, indicating the presence of water tables in the lower levels of the flows.

The Zuni uplift has been a geographic “high” for perhaps 200 million years. On its southeastern end adjacent to the northwestern part of the monument, it is in the shape of an enormous anticline (fold). The axis of this fold plunges southward beneath the surface of the monument where many of the older rocks have been buried by recent lava flows. The

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30. Flows from the Cerro Candelaria, Hoya de Cibola, and Bandera centers flowed only half-way down the valley, whereas flows from the El Calderon and McCartys centers reached present-day Grants and beyond.

area of the Zuni Mountains immediately north of the monument has been valuable economically for its fluorspar mines (Geological Survey, Goddard 1966). In addition, a high heat flow and other favorable factors have drawn attention to the potential of future geothermal energy sites in this southeastern section of the Zuni Mountains (Laughlin and West 1976).

## **Geologic Time and the Rocks of the Monument**

The age and origin of rocks within the boundaries of El Malpais National Monument represents discontinuous portions of a long geologic history over the past billion years, as summarized in the following table. Because 95 percent of the monument's surface is covered by young lava flows, and the natural resources in the area are dominated by these volcanic resources, only brief summary will be made of the older nonvolcanic rocks.

The southernmost exposures of Precambrian rock in the core of the Zuni uplift, represented by blocky outcrops of gneissic granite along NM 53, have not been dated by radiometric methods; they are likely to rank among the oldest rocks in New Mexico – possibly as old as the ancient granites and gneisses at the bottom of the Grand Canyon. Lying into McCartys Valley and on top of these ancient rocks are early Permian sandstones and limestones, which form hills in the **Bandera** area (such as Sandstone Ridge) and comprise the hill country of Cerritos de Jaspe (in the national conservation area). In contrast to these Permian formations exposed on the west side of McCartys Valley, the east side of the valley is dominated by younger sedimentary rock formed during the Jurassic and Cretaceous periods. In the national monument along NM 117, these tan to yellowish sandstones form the bench-and-cliff landscape at Las Ventanas and Sandstone Bluffs overlook and the kipukas south of Big Narrows.

## **The Shape and Material of Volcanoes in the Monument**

A volcano is any vent in the earth's crust through which gas and molten rock issue, and the shape may vary considerably depending on the chemical composition, gas content, temperature, and volume of the magma and the configuration of the vent.

Some earlier flows in the **Bandera** lava field erupted along long fissures and did not have the mountain-like forms popularly associated with volcanoes. The most common volcanic shape in the **Bandera** field is the cinder cone (typified by Twin and **Bandera** craters and the Chain of Craters volcanoes), in which gas in the rising magma explosively showered droplets of lava around a central vent and built up a circular rim of more or less loose cinders around it. A few of the cones also erupted liquid lava that rose in the crater and either broke through the weakened cinder walls or overtopped the crater and flowed down the outside flanks. In the unusual case of Lava Crater, a large portion of the cone was built up largely by lava without much addition of cinder.

The flow at McCartys Crater seems to be an example of a large lava flow erupted through a small vent, and there was not enough violent gaseous activity to build up a cone.

In a few cases in the El Malpais area, such as the early eruptions from Hoya de Cibola and Cerro Rendija, fluid lava poured out in all directions from central vents and built up very broad domelike forms called shield volcanoes.

## **The Most Recent Lava Flows and Their Accompanying Features**

**Bandera Crater and Flow.** The **Bandera** Crater area is the focus of the most intensive development proposed in the general management plan alternatives.

**Bandera Crater** – This crater and its associated 33-mile-long sequence of flows is the centerpiece of visitor activity in the national monument. Causey (1971, 27-29) notes that major red cinder eruptions produced the present volcanic cone (and gave **Bandera** its colorful contrasts compared to other craters in the area). He states that **Bandera** is the only cinder cone in the area that had a final eruption so violent that a deep crater was produced. The rim of the cone rises about 450 feet above its exterior surroundings and about 640 feet above the bottom of its inner crater floor. (The impressive viewpoint at the end of the existing trail into the crater is at the approximate vertical mid-point – 320 feet above the crater

**TABLE 7: GEOLOGIC TIME AND THE ROCKS OF EL MALPAIS NATIONAL MONUMENT**

<b>AGE</b>	<b>FORMATIONS/ TYPE OF ROCK</b>	<b>WHERE PRESENT IN NATIONAL MONUMENT</b>	<b>PERCENT SURFACE AREA OF NATIONAL MONUMENT</b>
Precambrian; the oldest rocks may be 1 billion years before present	Gneissic granite	Along NM 53 northeast of El Calderon; part of ancient core of the Zuni uplift	Far less than 1%
Early Permian, about 260 million years before present	Tan, gray, yellow, and red siltstone, sandstone, and limestone. Includes Abo and Yeso formations, Glorieta sandstone, and San Andres limestone.	South of NM 53 east and west of Cerro Candelaria and in other scattered locations in the western part of the monument.	About 2%
Middle Jurassic to late Cretaceous, about 150 to 65 million years before present	Tan and gray shale, sandstone, conglomerate, and minor limestone. Includes Mancos formation, and Tres Hermanos, Dakota, Zuni, and Entrada sandstones.	Along NM 117 corridor between the highway and McCartys lava flow. Forms Sandstone Bluffs overlook, the cliffs east of the Narrows, and kipukas south of Big Narrows.	About 3%
Quaternary to A.D. 700, the last 1 million years	Dark gray basalt flows and pyroclastic debris (cinders, spatter).	Covers most of monument. Consists of a) earlier flows confined largely to the western part of the monument, and associated with Cerro Encierro, Cerro Bandera, and Cerro Rendija, and b) later flows tending to flow east and north associated with El Calderon, Cerro Candelaria and Twin craters, Hoya de Cibola, Bandera Crater, and McCartys Crater	About 95%

floor). Most of the surface material in the cone is loose cinder, although layers of coarse material (agglutinate and lava) are also present. During the later eruptions that built up most of the cone, fragments of semifluid lava were ejected from the crater along with cinders, forming the volcanic bombs that are part of the deposits covering the land north and east of Bandera Crater. Some of these bombs are unusual, containing angular pieces of olivine gabbro from deep in the earth's mantle, and are particularly interesting to geologists studying the origin of continental basaltic rocks (Laughlin et al. 1972, 1548).

Geologists have long speculated about the source and chemistry of magma deep in the earth's crust and the significance of the Bandera area lavas in the evolution of this portion of the continent (Hatheway and Herring 1970; Laughlin and West 1976; Laughlin et al. 1972; Geological Survey, Luedke and Smith 1978). The sequence of eruptions at El Malpais and the chemistry of the lava will continue to be important research subjects in the future of the national monument. (See appendix N for more detail on these subjects.)

**Bandera Flow**<sup>31</sup> -What sets this flow apart from others of basaltic composition in the United States is not its volume or extent, which are exceeded in several instances, but rather two unusual sets of features.

First, the Bandera flow also contains what is probably the most extensive series of lava tubes – in a sense a vast “central plumbing system” – probably not exceeded in total length by any other such system in a single lava flow in the United States. The main Bandera tube system, some 16 miles long, contains individual tubes up to 7,000 feet long, with long subterranean sections and with many branches that add miles to the main 16 miles.<sup>32</sup>

Second, between 7,400 and 7,900 feet, the Bandera flow contains an unusually large number of ice caves and large volumes of ice within its lava tubes, possibly more subterranean ice than anywhere else in the contiguous western United States – and it is remarkable that this phenomenon occurs so far south.

Carlton (NPS 1988b and 1989a) inventoried the surface features in the upper 14 miles of the Bandera flow. The following six types of surface features are obvious in these reports as the best examples in El Malpais that can be easily seen and interpreted to the public in accessible portions of the Bandera flow (see appendix M for definitions):

- . spattercones
- . tree molds
- . lava surface tubes
- . the huge volcanic canyon below the mouth of Bandera Crater, which is at the head of the Bandera tube system

- . numerous pahoehoe, aa, and blocky flows in juxtaposition
- . spectacular examples of aa flows that overwhelmed pahoehoe terrain including collapse structures

When these features are added to the lava tubes, ice caves, and the diverse crater landforms of the Bandera flow, the Bandera Crater area emerges as the best overall place in the monument to interpret volcanic geology. Farther south on the Bandera flow, the East Rendija area with its massive collapses (including lava bridges) and its large continuous lava tubes (including windows, smooth floor sections, and falling-lava-level phenomena) is a close second to the Bandera Crater area.

**Bandera Flow Lava Tubes** – The most thorough analysis of lava tube formation in the Bandera lava field is that of Hatheway and Herring (1970), who concentrate mainly on the flows and tubes within the boundary of the present national monument. They state that the tubes of the Bandera Flow “represent the best-preserved and most concentrated group of tubes yet described,” that “groups of tubes as extensive as these are not common,” and that “smaller systems have been reported in the western United States, Alaska, Hawaii, Australia, Iceland, and in East Africa” (1970, 311). Hatheway and Herring believe that the Bandera tube system, which extends about 16 miles down valley from the crater, is common to three nearly simultaneous flow units or surges of lava. There is some uncertainty how this vast “plumbing system” functioned, but the result was one of the great lava tube systems of the world in terms of length and complexity.

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31. A radiometric date from an early lava flow at the base of Bandera Crater is approximately 188,000 years (Laughlin and West 1976, 5; and Geological Survey, Luedke and Smith 1978); however, based on a comparison of weathering of other flows in the Bandera field, some geologists believe that the main flows from Bandera Crater are more on the order of 10,000 years, or even younger (New *Mexico Geological Society Guidebook*, Laughlin et al. 1982, 283).
32. The origin of this tube system is complex but believed to be common to three pahoehoe units that flowed in virtually simultaneous progression (Hatheway and Herring 1970, 310), thus it can be considered a system belonging to a single flow.

In 1988 the National Park Service contracted Kent Carlton to inventory the natural resources of the lava tube systems of the national monument. His study concentrated on the **Bandera** tube system (see appendix N for further information). Carlton found that although less than 20 percent of the system is in the form of open caves than actually can be entered, the alternating sequences of subterranean passages, “windows,” and open collapse structures greatly varies the exploration experience along the tube system and contrasts with other such lava tube systems in the national park system.

Carlton found three main types of features associated with the **Bandera** tube system:

**Lava tubes.** The **Bandera** flow contains most of the monument’s “big caves.” These are of many widths and floor-to-ceiling heights throughout the explored part of the system, with the largest recorded dimensions (in separate caves) being 70 feet wide and more than 50 feet high. One single tube has sections 60 feet wide and 50 feet high. The longest continuous, unbroken passage is more than 3,000 feet. The longest known cave in the national monument – nearly 7,000 feet – is “punctuated” by seven short “windows” (ranging from only a few feet to 200 feet long). In some “subway” tubes with classic circular cross section, there are many passages that branch off the main passage and rejoin it. Some show so many rejoining branches that these caves are termed “braided.” Some caves have two parallel passages for long distances. In some sections of caves, or in adjacent collapse structures, three, four, even five tubes may join in short distances. Others exhibit a phenomenon of tubes at different levels – “stacked” systems, with two, even three tubes on top of each other.

In many of the tubes with smooth walls, “dripping lava” phenomena are strikingly beautiful. These include colorful “lavacicles” up to 2 or 3 inches long that hang from the ceilings and walls (formed from coalescing molten droplets of lava

when the tube was still hot). On cave floors in a few places, lava “stalagmites” up to 2 feet high were built up as molten lava dripped off the ceiling above. Some smooth cave ceilings and walls are cracked into intriguing mosaics of panels – red, orange, brown, black, and white, sometimes in stark contrast to one another – and in some respects looking like abstract paintings. In some caves “silver formations” stand out in sparkling jewel-like radiance; these surfaces are composed of surface droplets of water and layers of white calcium carbonate.

**Collapse structures.** Numerous segments of the **Bandera** tubes subsided or collapsed entirely during or shortly after the flow cooled. Undoubtedly, collapses have continued to the present on a smaller scale. The large collapse structures form major chasms up to 100 feet deep that extend great distances down the axis of the flow. The walls of many are abrupt, forming cliffs and even overhangs. Most are floored with irregular piles of angular rubble. The **Bandera** flow at East Rendija has the longest sections of subsidence, containing not only sheer-walled collapses but also areas where the hot surfaces merely sagged. One large sinuous collapse here has conspicuous twists and turns (Caterpillar Collapse); another has such continuous sheer walls that it has a striking “box canyon” configuration; yet another is 3,000 feet long and has seven natural bridges spanning it (Seven-Bridge Sink). Lava bridges are fairly common in the collapsed areas of the **Bandera** tube system; the longest is about 200 feet along the tube axis, and many are shorter and quite picturesque.

The largest subsidence feature in the **Bandera** system, Hoya de Cibola, is a long rubble-filled gash, 1,200 feet long, 500 feet wide, and 100 feet deep; the other massive pit is Hoya de Diablo, 800 feet long, 250 feet wide, and 60 feet deep. These enormous subsidence features seem to be sites of local widening and deepening of a lava tube

segment – or perhaps places where several parallel tubes collapsed in mass.

**Ice caves.** The greatest number – many dozens – are in tubes and crevices in the upper and higher elevation portions of the system in the vicinity of Bandera Crater. Many cannot be entered because their passages appear to be entirely choked with ice. Lower sections of the Bandera tube system also contain caves with ice, and few are among the monument's most important ice caves.

**McCartys Crater and Flow.** McCartys Crater, in the southeastern portion of the national monument, is striking because although small, it extruded an expanse of lava nearly 35 miles long, a volume of 1.7 cubic miles. The lava that erupted from the crater flowed northward along the east side of McCartys Valley for miles before it encountered the valley of the Rio San Jose, where it turned abruptly east and flowed a few more miles before ending. (Present-day I-40 outside the national monument and conservation area cuts through this interesting terminus of the McCartys flow.)

The low degree of weathering and sparse vegetation on the McCartys flow attest its being the youngest lava flow in the national monument; however, it has not been dated radiometrically. Crumpler (New Mexico Geological Society Guidebook, Crumpler 1982c, 293) notes that the flow was in existence at the time of the Coronado Expedition in 1540 and that Darton (1915) recorded Indian legends about a river of fire along the Rio San Jose that buried prehistoric fields. Nichols (1946, 1056) indicates that Pueblo I potsherds were found well below the surface of alluvium near Laguna, which is similar to the alluvium covered by the flow terminus at McCartys. This suggests the flow may have occurred during early Anasazi occupancy of the valley, and therefore the McCartys flow is tentatively dated at A.D. 700 or younger (Geological Survey, Luedke and Smith 1978).

The McCartys flow, perhaps the youngest in New Mexico, differs greatly from the Bandera flow in several ways. The McCartys has extremely fresh pahoehoe lava surfaces with a "poured-out-yesterday" look and sparse vegetation, including many early-generation trees that are dwarfed and twisted. In general it lacks lava tubes (and, of

course, ice caves). Spattercones are also generally absent except for a field of 32 spattercones near the La Vieja area. Most examples of surface tubes are also absent.

Nichols (1938, 1939, and 1946) inventoried many of the surface features of the McCartys flow. Outstanding features that are the best examples in El Malpais include

- squeeze-ups
- spectacular pressure ridges (transverse and longitudinal), some of which are sinuous
- a variety of pahoehoe phenomena that are obvious reminders of the fluidity and plastic character of the flow surfaces: broad swells; surface blisters; circular and ovate sags, sinks, pits, and other collapse features; ropy surfaces; and diverse examples of lava breaking out of fissures onto the flow surfaces

Although the edge of the lava flow parallels parts of NM 117 and could be reached in a relatively short distance from the roads, some of the flow areas have fragile soils and sensitive plant communities, and other areas are special to the Acoma Indians. Only one small area (at the Narrows) affords a suitable opportunity for visitor exploration of these interesting lava surfaces.

**Other Flows in the National Monument.** There are several flows within the monument other than the Bandera flow.

**Lava Crater Flows** – The tube system in this series of flows contains some of El Malpais' most impressive lava and ice caves, particularly in the steep upper portions below the crater. In overall cross-sectional proportion, Dripping Lava Cave may be the largest tube in the national monument. The first 500 feet contains floor-to-ceiling heights of 70 feet and widths of 50 feet, and the tube descends at a steep angle to its terminus 1,200 feet from the entrance; the end may be farther below the surface than any tube in the monument. The cave contains colorful ceiling sections and a perennial ice pond. Downslope from Dripping Lava Cave, a tributary aa flow from the Bandera flow covers the Lava Crater tube system, and there is evidence that the younger lava overwhelmed and filled tubes in the older tube system.

**El Calderon Flows** – This impressive system begins at the mouth of El Calderon’s crater as an open, canyonlike open channel filled with rubble. Lower sections, including subterranean portions, split into two long tube systems. One system contains numerous sinks, including the pitlike Double Sinks (more than 60 feet deep and separated by a thick lava bridge) and the 3,000-foot-long Junction Cave, which is the only tube in El Malpais showing evidence of flooding by water. The other system contains a collapse structure that opens into a west tube (cold and containing beautiful lava dripstone) and an east tube (Bat Cave, which is the warm-weather habitat of a large colony of Mexican free-tailed bats numbering in the thousands).

**Twin Crater Flows** – This system is lengthy but not very impressive. It has a few sinks, a bridge, and some small accessible caves, but it is very difficult to identify on the ground because it has only a slight discontinuous sag rather than many collapse structures. The tubes may have unusually thick roofs, which keeps the system largely inaccessible.

**Cerro Rendija Flows** – Cerro Rendija is a small shield volcano (2 miles in diameter) just outside the west boundary of the national monument. Its two known tube systems are not rich in caves, although some of the crevices are deep and contain ice. Fern Sink, the monument’s most impressive circular collapse structure (100 feet in diameter, 75 feet deep) is part of the system. The lower sections of the system appear to have been entirely overrun by the younger Bandera flow. To reduce confusion, it should be understood that the “East Rendija” tubes of the Bandera lava flow as described elsewhere are east of Cerro Rendija and are not part of the Cerro Rendija tube systems described here.

**Hoya de Cibola Flows** – Flows of the older Hoya de Cibola eruptive center contain impressive lava tubes and collapse features. Hoya de Cibola, an extremely large subsidence pit, is 2,000 feet long, 650 feet wide, and more than 100 feet deep. The caves in the system are of surprising size and length as well as great beauty. Five of the six explored caves contain such features as

smooth “subway” tunnels, sections of “stacked” and parallel tubes, skylight windows, domed ceilings, areas of intensely red color, and cross-sectional dimensions with heights up to 30 feet and widths up to 50 feet. The sixth cave, Braided Cave, is among El Malpais’ longest. Not only does it have numerous branching tubes with intervening pillars and smooth floors, but its dripping lava formations are among the most colorful in the monument.

**Other Flows** – Flows originating from other eruptive centers in the monument, including Cerro Bandera and Lost Woman Crater, did not have the type of lava or other characteristics such as proper gradient to form extensive lava tubes. It is also important to note that the known tube systems have not been thoroughly explored, including the lower 2 miles of the Bandera system.

## PALEONTOLOGY

The monument has not been surveyed for paleontological resources. There is potential for fossil resources in certain formations in the monument such as the Dakota sandstone, Mancos shale, and San Andres limestone. Elsewhere, these formations are known to contain fossilized marine invertebrates and plants.

## MINERALS

Areas in the larger region are being developed for energy resources including coal, uranium, natural gas, oil, and geothermal steam. However, a preliminary report indicates that there are no major significant mineral or energy resources within the monument (Geological Survey, Bigsby and Maxwell 1981).

Deposits of basalt and cinder are common in the monument. There are three open-pit cinder mines in the northeastern part of the monument; one of these is still actively mined and the other two are inactive. The monument also contains a 25-acre borrow pit (inactive) and an old sandstone quarry. These pits are a visual intrusion, and the mining of cinders is a loss of volcanic resources. Because the mines are on private lands, no action can presently

be taken by the Park Service to close or reclaim them.

Some of the lava tubes contain small clusters of unusual and delicate minerals, including trona, burkeite, and thenudite. The extent of these deposits is unknown.

## SOILS

The surfaces of the most recent volcanic flows have little or no soil. Soils that have accumulated are primarily wind-blown deposits, varying from shallow in crevices to deep where there are small fans and playas along the edge of the lava flows. In older flow areas, such as El Calderon and Lava Crater, there is a definite soil profile -thin and stony. Most soils on the lava areas have good drainage, are not highly erodible, and are well suited for facility development. Mound sanitary discharge systems may be required where soils are shallow.

Soils along the monument's eastern boundary are derived largely from sandstone and shale. Whereas soils on the bluffs are generally shallow, which limits vegetation composition and density, soils at the base of bluffs are loose silt and sand eroded from the cliffs above. All these sandy soils are unstable and highly erodible, which limits facility and recreation potential. However, soils in areas such as Sandstone Bluffs could be stabilized with engineering fabric and base aggregate.

## VEGETATION

A vegetation study for the monument and conservation area was recently completed by the Bureau of Land Management. This study, conducted by remote sensing methods, identified eight major vegetation classes and numerous subclasses in the monument. The major vegetation classes are as follows:

**Lava** (approximately 35 percent of monument surface area) - The lava vegetation class is found primarily in the eastern and northwestern portions of the monument. Cracks, crevices, and small depressions within the lava contain tree species such as ponderosa and pinon pine and juniper. However, with limited area for root expansion, trees tend to be stunted, twisted, and

contorted. Shrubs and grasses in the lava flows include Apacheplume, New Mexico privet, current, oak, rabbitbrush, California brickellbush, skunkbush sumac, Wright sagewort, rough golden aster, wax currant, and blue grama. Forbs include many composites and mint species. There are also numerous cactii, but not all species have been identified. Lichens are well represented, with more than 70 species known. Fragile moss-lichen-fern plant communities grow at the entrances to the caves and below the larger lava tube windows. Additionally, ice water algae communities are found in some of the caves.

**Sparse/bare** (approximately 5 percent) - This class, characterized by exposed rock or soil with grass clumps and low scattered shrubs and forbs, is found mainly along the eastern edge of the monument. Grasses include blue grama, galleta, and other warm season species. Typical forbs include kochia, composites, and sunflowers, which cover large areas and are a significant source of seed for birds. Western wheat grass is dominant in playas.

**Grass/shrub** (approximately 5 percent) - As with the sparse bare vegetation class, the grass/shrub class is also common along the eastern edge of the monument. This class is characterized by blue grama in sod interspersed with forbs, mixed grasses, and shrubs such as horsebrush, sage, snakeweed, and rabbitbrush. There are scattered areas of pinon and juniper.

**Shrub/conifer** (approximately 5 percent) - This class is open mixed conifer with a grass-shrub understory. At lower elevations (6,800 to 7,600 feet) and on south-facing slopes, shrub/conifer is typically a mixture of pinon/juniper with an understory of blue grama, rabbitbrush, snakeweed, current, rhus, horsebrush, and other grasses and forbs. As elevation increases, and on north-facing slopes, ponderosa pine becomes common. Alligator bark juniper is also common. Oak in the understory provides excellent deer habitat. In and around Bandera Crater, Douglas fir is part of the conifer complex.

**Mixed conifer** (approximately 45 percent) - This is the most widespread class and is common in the central, northern, and western portions of the monument. The mixed conifer class contains the same species as described in shrub/conifer except the forested areas are denser and interspersed with small meadows. Some areas included contain mature trees with an understory of young trees of the same species, as well as the typical grass/shrub understory.

**Pinon juniper woodland** (approximately 1 percent) - This class is patchy and covers only small areas. It is characterized by a thick growth of mature pinon pine and juniper trees. Scattered ponderosa pines also occur.

**Deciduous** (approximately 2 percent) - Characterized by stands of oak and groves of aspen, this class creates an edge effect along the lava margins. In some places, deep, moist soils contain unusually large oak trees. Although the deciduous class is very small overall, it is of special management concern because of the important wildlife habitat associated with it.

**Ponderosa parkland** (approximately 2 percent) - This class is composed of climax stands of ponderosa pine interspersed with grassy meadows. The understory is typically June grass, mountain muhly, mutton bluegrass, and grama. This class is maintained by regularly occurring natural wildfires.

In addition to these eight principal vegetation classes, there are a number of smaller unusual and easily disturbed vegetative communities and species, some of which were described briefly above. More detail follows.

Almost all flow edges, even if only a few feet high, are zones where water collects and provides moist growing conditions. These narrow zones, called lava-edge ecotones, contain many trees, shrubs, and forbs in unusual density. These ecotones are rich in vegetative and wildlife diversity and are aesthetically attractive to visitors.

In the east-central portion of the **McCarty's** lava flow are scattered stands of dwarfed ponderosa pine. Because of severe growing conditions, these trees

are stunted, twisted, and contorted into bizarre shapes. Some of these pygmy pines may be hundreds of years old.

Limber pine have been found on only one of the monument's craters. Although not an unusual species in the region, this is the only known occurrence in the monument.

Sensitive moss-fern-lichen communities are found primarily near cave entrances and windows, and ice water algae communities are found in some ice caves. These plant communities are sensitive to disturbance, and the potential for adverse impacts is high because of the popularity of caves. Two New Mexico sensitive plant species, the grass fern (*Asplenium septentrionale*) and maidenhair spleenwort (*Asplenium trichomanes*), have been found in the monument. Lichen species are numerous. One study (DeBruin 1984) identified 75 lichen species along NM 117, including four uncommon species.

One of the types of cactus of particular concern is the hedgehog, which is abundant on the lava. Young plants are difficult to see and highly vulnerable to trampling. The mature hedgehog is popular with cactus collectors.

Because many of the monument's kipukas are isolated by rugged lava they are relatively undisturbed. In certain kipukas vegetation is as close to the original biotic condition as anywhere in the entire El Malpais region. Big and little **bluestem** and Arizona fescue grasses occur there in virtually undisturbed stands. Kipukas made of calcium rich rock may support unusual plant associations and perhaps even endemic species. One such area is **Mesita Blanca**, a kipuka of San Andres limestone, which has not yet been inventoried. Other rare or unique plant associations or species also may be discovered.

Inverted lifezones also occur in the monument. These exhibit such relationships as aspen growing at lower elevations than pinyons and junipers.

The sparse bare and grass/shrub vegetation class areas have been and are still used for grazing of livestock. Impacts on native vegetation and wildlife are not well documented. Exotic species such as Russian thistle, cheatgrass, kochia (chickweed), crested wheatgrass, and alfalfa appear to be well established.

## WILDLIFE

The lava fields and adjacent forests and shrublands are habitat for approximately 150 species of wildlife. The lack of permanent water limits wildlife numbers, and the rugged lava rock restricts wildlife movement. Before establishment of the monument, hunting, trapping, and predator control techniques were used to manage certain wildlife species. Under the legislation establishing El Malpais National Monument, all public hunting, trapping, and predator control is now prohibited.

Common avian species include Steller, scrub, and pinyon jay; robin; mourning dove; downy and ladder-backed woodpecker; rock wren; white-breasted nuthatch; mountain and western bluebird; rufous hummingbird; horned lark; western meadowlark; cliff swallow; mountain chickadee; and scaled quail. There are also kestrel, prairie, goshawk, red-tailed, Cooper's, and rough-legged hawks, and great horned, pygmy, long-eared, and burrowing owls. Golden and bald eagles sometimes forage in the monument. The sandstone cliffs along the eastern side of the monument provide raptor nesting habitat. Raptor nesting has been declining in recent years, but the reasons are unknown. The turkey vulture and common raven also use the cliffs. Wild turkeys have been observed in the northwestern part of the monument.

Common mammalian species include mule deer, porcupine, striped and hog-nosed skunk, long-tailed weasel, black-tailed jackrabbit, desert and mountain cottontail, and a variety of rodents. Areas of deep soil along the monument's eastern boundary are habitat for the Zuni prairie dog. The most common predator is the coyote, but black bear, mountain lion, badger, long-tailed weasel, gray fox, and bobcat are occasionally seen. Pronghorn use the area south of the Laguna flow. Elk are occasionally seen in the higher elevations of the northwestern part of the monument.

The monument provides summer and winter habitat for a variety of bats including Mexican free-tailed, Townsend's big-eared, hoary, pallid, big brown, and several myotis including long-eared, fringed, long-legged, and small-footed. The monument may also contain habitat for silver-haired, big brown, and spotted bats. There are several bat caves and colonies in the monument, but by far the most popular is the one near El Calderon where the

summer Mexican free-tailed bat colony has been estimated at 6 to 8 thousand.

Monument reptiles and amphibians include the black-tailed, western diamondback, and prairie rattlesnake; western black-necked and western terrestrial garter snake; bull snake; mountain patch-nosed snake; regal ringneck snake; night snake; tiger salamander; and a variety of lizards, toads, and frogs. Habitat for frogs, salamanders, and some toads is restricted to playas, stock ponds, small springs, and other permanent sources of water, which are limited. Some of the mammals and reptiles have melanistic characteristics.

The monument supports no fish species.

Extirpated species include the gray wolf (*Canis lupus linnaeus*) and bighorn sheep (*Ovis canadensis*).

## THREATENED AND ENDANGERED SPECIES

A threatened, endangered, and rare plant survey (New Mexico Dept. of Natural Resources, Spellenberg 1979) concluded there are no state or federal threatened or endangered plant species in areas now part of El Malpais National Monument. Representative regional habitats were surveyed, with "high potential" sites particularly well covered. Surveyed areas included Quaternary and Tertiary lava flows, cinder cones, sandstone "islands" (kipukas), and areas adjacent to El Malpais. The survey recommended a second inventory be performed late in the season to document the presence or absence of certain late-flowering species. However, it was doubted that any of the late-flowering species would be present because of lack of adequate habitat.

The U.S. Fish and Wildlife Service identified the endangered American peregrine falcon (*Falco peregrinus anatum*) as the only federally listed threatened and endangered species to potentially occur in the monument. In addition to the peregrine falcon, there have been three recent documented sightings of the federally listed endangered bald eagle (*Haliaeetus leucocephalus*). The bald eagle is believed to use the monument only as a migrant, but could also be a winter resident. The monument is not considered critical habitat for the bald eagle because of the lack of aquatic resources. The New Mexico Department of Game and Fish has also

identified the federally listed endangered black-footed ferret (*Mustela nigripes*) as formerly occurring in the area. The state also identified nine species that are on the federal notice of review list, including the following:

- Townsend's big-eared bat (*Plecotus townsendi*) - winter resident
- white-faced ibis (*Phalacrocorax olivaceus*) - migrant
- Swainson's hawk (*Buteo swainsoni*) - migrant
- ferruginous hawk (*Buteo regalis*) - migrant/breeder
- spotted bat (*Euderma maculata*) - on nearby Mt. Taylor
- mountain plover (*Charadrius montanus*) - breeds in the nearby North Plains area
- long-billed curlew (*Numenius americanus*) - migrant
- "western" yellow-billed cuckoo (*Coccyzus americanus occidentalis*) - migrant
- "southern" spotted owl (*Strix occidentalis lucida*) - resident in the nearby Zuni Mountains

Because most of these species are migrating through the area, they will probably not pose much limitation on management of the monument.

Although federal notice of review species do not have legal status, if these animals are found in the monument protection will be provided until their status is determined by the U.S. Fish and Wildlife Service. Protective measures would include identification, monitoring, and habitat protection.

## GRAZED LANDS

Grazing of livestock has been an important source of income in the region for the past 150 years. The rough lava terrain restricts livestock movement. The legislation establishing El Malpais National Monument allows the continuation of grazing until December 31, 1997. The impacts of grazing on native flora and fauna have not yet been evaluated.

Several rangeland developments in the monument, primarily along the periphery, consist of earthen and metal stock tanks, barbed wire fences, corrals, one windmill, and buried plastic water pipelines. Livestock operators occasionally use motorized vehicles and equipment to maintain these developments.

## WATER RESOURCES

El Malpais National Monument is just east of the Continental Divide in a closed hydrologic basin known as the North Plains and the Malpais Lava Beds. Although the surface of the monument is noted for its lack of water, water does occur in isolated sinks and caves and supports certain ecological and aesthetic values of the monument.

Stream flows last only for short periods in response to infrequent rainstorms and snowmelt. Storm waters collect in depressed areas as ephemeral pools. These pools occur both on the surface of the lava flows and in low areas dammed by the lava flows. The ponding of surface water only temporarily indicates that recharge to ground water occurs. Although not well understood, this interaction between surface and ground water is likely an important natural process in the lava flow environment.

The northern part of the monument is in the Bluewater Ground Water Basin, and the southern portion is in the Rio Grande Ground Water Basin. The ruggedness of the lava landscape historically restricted human occupation, including the development of ground water. Because of this, information on ground water resources is very limited. Successful wells are along the periphery of the monument beyond the margins of the lava flows. These wells generally provide only small volumes of water for domestic and stock use. The wells tap water from alluvium or thin aquifers and produce about 5 to 10 gallons per minute.

The San Andres-Glorieta aquifer, about 500 feet below many areas, is the major subsurface source of water. This aquifer is in consolidated sedimentary rocks beneath alluvium and basalt. Several wells outside the monument draw water from the San Andres, but development of wells this deep is expensive.

Other potential sources of ground water are at the base of the basalt flows, which appear to be sufficiently fractured to act as an aquifer. However, where penetrated by wells, many of these sites have been dry.

The availability of ground water for monument use is still uncertain. Further studies of the geology and hydrology, especially the Bandera Crater area, are needed. A preliminary analysis by the NPS Water

Resources Division of the Washington Office concluded that the potential for low yield wells (5-10 gallons per minute) for proposed facilities along the eastern monument boundary is fair to poor. The underlying Chinle Formation is noted for both very low yield and inferior water quality. Obtaining adequate ground water supplies for the proposed Bandera development is speculative, but nonetheless will be attempted by means of test wells prior to further planning for facilities.

## **FLOODPLAINS AND WETLANDS**

Analysis of the monument by the NPS Water Resources Division of the Washington Office identified only one floodplain – in the southern part of the multiagency center site near Grants. However, the proposed boundary change in this area will remove this floodplain from the monument.

Most of the monument is covered by porous, fractured lava that absorbs most rainfall. Areas immediately adjacent to the margins of the lava flows are subject to temporary ponding during heavy rain and are probably not suitable for development of facilities. Most proposed development sites are in well drained areas or near the head of watersheds that are not subject to dangerous flooding.

Because of the lack of water, the monument does not contain any wetlands. There are wetlands adjacent to the monument, including Ojo del Gallo spring near San Rafael and the lava-edge ponds along I-40. The temporary ponding of water along lava flow margins does not trap enough moisture to support hydrophilic (wetland) vegetation.

## **AGRICULTURAL LANDS**

There are no prime or unique agricultural lands in the monument.

## **AIR QUALITY**

El Malpais National Monument is designated a class II area under the 1977 Clean Air Act (42 U.S.C. 7401 et seq.). Because of the lack of specific monitoring, it is unknown whether standards of that designation are being met within the monument. However, because of its rural

location and because the air in Cibola County meets or exceeds the national ambient air quality standards, the quality of air in the monument appears to be good to excellent. There are, however, short periods of regional haze. Several lichen species are extremely vulnerable to pollutants; a 1984 study found no indication that lichen at El Malpais were being affected by pollutants at that time (DeBruin 1984). Prevailing winds are from the west and south.

Air quality and air quality related values (AQRVs) are extremely important monument resources – vital to protection of other sensitive resources in the monument and also to visitor use and the interpretive story.

Regional energy development, both planned and existing, may be a threat to air quality because of reduced visibility and increased SO<sub>2</sub> levels. Energy-related development includes coal-burning power plants, strip mining, uranium mining, heavy truck traffic, and increased urbanization. There are no major sources of air pollution in the immediate vicinity of the monument; however, there are major sources of pollution in the region. These include coal-fired power plants at Thoreau, New Mexico (approximately 50 miles away, which burns approximately one million tons of coal per year), Farmington, New Mexico (125 miles away), and Holbrook, Arizona (175 miles away). Construction of a second 233 megawatt coal-fired power plant near Thoreau is being considered. The proposed Bisti coal-fired power plant, about 85 miles north of El Malpais (near Chaco Culture National Historical Park), could also have an adverse impact on the monument's resources if it is constructed.

Mining, another potential source of pollution, is a major economic activity in western New Mexico. The uranium mining around Grants, a possible source of particulate matter, is essentially shut down. The nearest copper smelter is in Hurley, New Mexico, 165 miles southwest of the monument. Other smelters are in El Paso, Texas, southeastern Arizona, and northern Mexico. The El Malpais region contains several large coal fields, and increased energy development in the region could diminish the existing air quality.

## **VISUAL QUALITY**

Air quality affects the clarity of views of distant landscape features, as discussed above. Land management practices outside the monument also affect the landscape itself. Mines, roads, and powerlines affect monument viewsheds.

Visual quality of the distant landscapes that form the backdrop of the major monument features is very important to the visitor experience. Some of these features are described in the “Affected Environment” section (under “Geographic Setting”). Many of these features could become obscured on certain days if air quality standards are not protected.

Within the monument, shrublands and forested areas along the lava margins contain most of the visual evidence of human use and development. These areas have been heavily grazed and timbered and some contain important transportation corridors. The monument also contains three cinder pits, a 25-acre borrow pit, and an old sandstone quarry – major visual intrusions.

## **AUDIO QUALITY**

Natural quiet is an aesthetic resource that greatly contributes to a visitor’s sense of solitude and serenity. With limited regional development and human occupation, El Malpais provides the visitor with this important resource. However, activities such as overflights, particularly military low-level flights, encroaching development, and increased vehicular traffic threaten this value. Excessive “noise” can diminish a visitor’s overall experience and negatively impact fragile wildlife species. Protection of monument “quietness” will include NPS participation in regional planning and development activities and consultation with other agencies to limit activities such as overflights.

## CULTURAL RESOURCES

The Southwest is rich in cultural resources, ranging from spectacular cliff dwellings and massive pueblo ruins to small, unobtrusive scatters of potsherds and chipped stone. Some of these remains can be traced through time to the contemporary tribes who still occupy these lands. The region's cultural resources also include Spanish colonial, Mexican, and Mormon settlements along with a variety of early ranching, farming, mining, and logging sites. All the resources document a continuum of over 10,000 years of human history in a region where great ecologic and scenic diversity has helped shape human adaptation and change. Many of these resources are unique to the El Malpais and are a vast storehouse of valuable scientific and historical data.

A brief summary of the area's prehistoric and historic archeological resources is given in the following sections.

### PREHISTORIC ARCHEOLOGICAL RESOURCES

The continuum of human occupation in the El Malpais area began some 10,000 to 12,000 years before present and continues unabated to this day.<sup>33</sup> Scientists think the very earliest Paleolithic hunters subsisted, in part, by hunting large, now-extinct animals. Only a few scattered traces of these hunters – bone and stone tools, simple hearths, and the remains of the quarry they pursued – remain behind.

Over the next 10,000 years, the climate changed, many of the large mammals became extinct, and human cultures changed and adapted. Subsistence patterns gradually changed from big-game hunting to smaller game and then to seasonally scheduled gathering and hunting – a time known as the Archaic period. The later inception of horticulture and settled villages was accompanied by population increases and improved technologies.

The Basketmaker period (following the Archaic) is marked by the first appearances of plainware

pottery, the bow and arrow, and pit houses. By A.D. 500, these people, now known as the Anasazi, were present across all of northcentral and northwestern New Mexico. These farmers raised corn, beans, and squash, supplementing their diets by hunting and limited gathering.

Basketmaker sites occupied many different environmental settings, but many were in wide valley bottoms or on the higher sand hills. Storable food surpluses allowed increasingly larger groups of people to stay longer in one place, building permanent homes in villages.

By A.D. 800 (the beginning of the Pueblo I period), the Anasazi were living in semi-subterranean pit houses. These structures had stone foundations, jacal walls, and surface storage structures arranged around the pit houses in a crescent. These small pit houses were often built in narrow canyons near low cliffs. It is likely that increases in cultural complexity, political organization, religious activity, and trade accompanied the increasingly sedentary way of life, agriculture, and new technology. Fewer than 10 sites with components dating to this time have been documented in the monument.

Over the next 250 years, the Pueblo II period (approximately A.D. 950-i 100) communities made up of small villages spread throughout the area. Most were built on small benches or hills at the sides of canyons. The modest Anasazi pit houses were gradually replaced by rows or clusters of rectangular multifamily dwellings of poles and mud or stone slabs with adobe mortar. These surface rooms were aligned on a north-south axis with a plaza and kivas on the east. Within these roomblocks, special activity rooms were common. Many of the numerous pottery types from these sites appear intrusive, suggesting that these people may have been trading with or influenced by groups outside the region.

Elsewhere in the region, other major changes were underway. A large population center began to develop at Chaco Canyon sometime between A.D.

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33. With some exceptions, the following discussion was abstracted from the 1988 report on cultural prehistory of El Malpais by Ireland (NPS 1988a).

800 and A.D. 950. Eventually the influence of the Chaco Canyon culture spread outward to certain Anasazi villages – now known as Chacoan outliers.

By about A.D. 1050 these Anasazi had become part of the larger, integrated, highly organized, hierarchical, centralized socioeconomic and political system known as the Chaco Phenomenon. Chaco Canyon probably served as the central place for a core of institutions and highly ranked personnel. Some think it may have been the administrative, economic, and probably the ceremonial center of a complex Anasazi trading network, which included as many as 75 outliers. The larger Chacoan sites are characterized by large-scale construction activities, including monumental public architecture, large towns, and water control features.

An extensive system of wide, straight, beautifully engineered roads and associated signal stations extended across 150,00 to 300,000 square kilometers of the northern Southwest to connect the outlying villages to the central core of the system, Chaco Canyon.

Las Ventanas, 70 miles south of Chaco Canyon in El Malpais National Monument, is an important Chaco outlier dating to about A.D. 1150 to 1200 (Pueblo II and III periods). This archeological site, listed on the National Register of Historic Places, contains Chacoan structures such as a great kiva and a prehistoric roadway set in the midst of an Anasazi community.<sup>34</sup> The pueblo, now buried, has approximately 60 ground-floor rooms and perhaps as many as 30 upper-story rooms. Shaped basalt from the adjacent lava flows and sandstone from the surrounding cliffs was used for construction. The great kiva has four well-defined alcove rooms. A tower kiva, at least two stories high, is within the pueblo. The site's location near the edge of the lava flows, and some of its other characteristics, make it one of the more unusual of all the 75 or more outliers in the Chacoan region.

Large communities, growth in artistic development, and intensive local specialization in artifact manufacture are the hallmark of the late Pueblo III

period. Virtually all of the earlier sites in topographically higher settings were abandoned during this period, and large habitation sites were built near good farming soils at the mouths and in the broader portions of canyons or on the edge of plains. Later sites could be found on the flat-topped mesas in this area. Over time, there were slight changes in intra-village arrangement.

After about A.D. 1200, the number of Anasazi sites in the El Malpais region began to decrease. There was a general decline from the cultural acme of the Pueblo III period, suggesting a reorientation in economic and cultural affiliations. Numerous sites were abandoned during this period as peoples moved into a very few extremely large sites such as Acoma Pueblo itself, which may have been founded earlier. Glaze-type pottery was introduced during this period, and pottery types from the Hopi, Zuni, and the Rio Grande regions appear in sites near El Malpais, suggesting continued movement and cultural interaction. Several sites in the national conservation area are from this period.

Approximately 130 archeological sites have been recorded in the monument. Three-fourths of these are Anasazi, most dating to between A.D. 700 and A.D. 1300, especially from the Pueblo II and III periods. Ten Archaic and three Mogollon sites have been reported; most others are of undetermined cultural affiliation.

The archeological sites in El Malpais represent the continuum of use by a number of different cultures and are varied in type, period, location, and size. These sites are significant for a number of reasons. Those in El Malpais are often associated with special lava features, illustrating past human religious and subsistence activities. These sites can tell us of specialized use of environmental niches or of selected resources (such as ice) found only in certain areas and can elucidate the complex human adaptation to this rugged, arid landscape. Several different cultural groups used this area; related sites can illuminate past trading activities, economics, and cultural contact. El Malpais contains one of the southern-most Chacoan outliers and roadways –

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34. The description of Las Ventanas was taken from Marshall et al. 1979, 187-193.

important to the broader understanding of the entire Chacoan system.<sup>35</sup>

Sites range in size from a square meter to larger than 10,000 square meters; nearly half encompass more than 1,000 square meters. The varied site types and features include occasional rock art and small scatters of lithic and ceramic sherds; isolated structures such as field houses and jacal or masonry rooms; and pueblo villages with large roomblocks, kivas, middens, and storage areas. Half of the reported sites contain masonry rooms or roomblocks. Some prehistoric sites are important to contemporary American Indian groups.

Because of the focus of past archeological investigations, the majority of the sites reported for El Malpais are clustered in drainages away from the lava and along the eastern boundary of the monument, especially in the Las Ventanas area.

At the time of survey, about half these sites were reported as "intact" or in good condition; others, especially the large prehistoric sites, had been vandalized, had had mechanical disturbance, or were impacted by grazing. Because of ongoing erosion, pot-hunting, and other human use, it is likely that only a few of these sites are intact today. Only a handful of sites have been archeologically tested or excavated, or have curated collections.

Despite the richness and apparent uniqueness of the area's sites, only a very few have been evaluated for the National Register of Historic Places. The Las Ventanas site, also known as Candelaria Pueblo, was added to the National Register of Historic Places in 1983.

Descriptions and locations of archeological sites generally are not included in this general management plan for two reasons. First, because so little of the monument has been surveyed and existing data are inadequate, descriptions of known sites would present a misleading picture of the area's total cultural resources. Second, because resource protection is a primary focus of the plan for cultural resources, protection of site identity and locations until archeological work can be accomplished is vital.

## ETHNOGRAPHIC RESOURCES

Scholars have made arbitrary divisions in describing the continuum of human occupancy in the Southwest to accommodate the different research disciplines of archeology, anthropology, history, and cultural geography. This should not be so, for the continuum is a long and unbroken chain that links peoples, past and present, to the land. To quote a Taos Pueblo man –

We have lived upon this land from days beyond history's records, far past any living memory, deep into the time of legend. The story of my people and the story of this place are one single story. No man can think of us without thinking of this place (Henry et al. 1970, 35).

For thousands of years, the region has been home to many different American Indian groups. Prehistoric peoples and their descendants, including the modern-day Indians of the Acoma, Laguna, and Zuni pueblos, and the Ramah Navajo, have hunted, gathered, and worshipped here, building homes and shrines, and cultivating fields. The Pueblo peoples who now occupy the villages of Zuni, Acoma, and Laguna are descendants of the architects of Chaco Canyon, Mesa Verde, and other Anasazi places across the Southwest. In the face of rapid cultural change, the present-day pueblos have maintained lifeways tied to seasonal or cyclical ceremonials, retaining their "gentle and unobtrusive character, customs, institutions, and art forms" (Ortiz 1979, 1).

Over the past two centuries, history has changed the ways these peoples live upon the land. Large areas formerly used solely by Indians are now reduced to large blocks of land under private and government ownership. In creating the El Malpais National Monument/ National Conservation Area, lawmakers were acutely aware of these divisions and of the many concerns expressed by American Indian groups. The law reflects this awareness by providing for continued tribal use of El Malpais, ensuring that Indian peoples have nonexclusive access to monument and conservation area lands for traditional cultural and religious purposes.

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35. The New Mexico state plan now in preparation will identify specific themes and historic contexts relevant to the El Malpais area.

## Acoma Pueblo

Acoma peoples especially claim ancestral ties to the El Malpais area, citing prehistoric use of the Acoma Culture Province, an area that stretched roughly from the Rio Grande west to El Morro.

Although initial Spanish colonization and missionary efforts were focused mainly on pueblos in the Rio Grande Valley, the Spanish search for precious metals, their attempts to convert the Indians to Christianity, and their forceful seizure of tributes of food and clothing eventually led to conflict with the western pueblos of Zuni, Acoma, and Laguna as well. In 1598 the Spanish explorer Onate led an expedition to Acoma. Fifteen of his soldiers who were demanding tribute were killed, and in retribution the Spanish destroyed the pueblo and took 500 captives as slaves.

Within a few years, most of the captives had escaped and returned to rebuild the pueblo, and by 1630 the Acoma population was reported at 2,000 people. Historical documents cite year-round occupation of Acoma Pueblo and the seasonal use of farming villages in Cebolla, Cebollita, Paradise, and Locomotive canyons near El Malpais during the mid 1600s.

In 1680 the pueblo groups banded together in an attempt to drive out the Spanish. Survivors of this revolt against the Spanish scattered across northern New Mexico, seeking refuge among other pueblo groups, including the Acoma. Although this revolt loosened the Spanish hold on the Rio Grande pueblos for several decades, it was at a high cost to all native residents because of battle deaths, starvation, and disease. By the 1700s the Spanish felt that "the western Pueblos of Acoma and Zuni had offered their submission" (Simmons 1979, 187).

Over the next half century, incursions by Apache and Navajo groups drew the Spanish and the Pueblo peoples together, and eventually with this new alliance the pueblos began to recover a semblance of prosperity. During the late 1700s, large flocks of sheep were bred at Acoma, Laguna,

and Zuni, and the wool was used to produce fine blankets.

Today the Acoma occupy the farming villages of McCartys and Acomita. Families maintain homes in Acoma Pueblo for use during ceremonial observances, but most Acoma live elsewhere on the reservation. Guided tours of Acoma Pueblo, also known as Sky City, give visitors a chance to see their pottery and the site of their ancient pueblo.

Like many other present-day pueblo groups, the Acoma people maintain a close society, protecting the secrecy of their religious activities and their "right to keep the knowledge of the culture within" (Garcia-Mason 1979, 451). The location of Acoma Pueblo atop a high mesa reinforces this perception.

The Acoma share basic architecture and art designs with other pueblo groups. Language, dress style, music, dances, and food preparation are also similar among the Keresan-speaking pueblos. Spanish influences were never as pronounced at Acoma as among the eastern pueblos because of its more remote location and distinctive history (Garcia-Mason 1979, 452).

The Acoma stress clanship. Families claim descent, proscribe marriages and preferred residency through matrilineal clans, which also may, upon occasion, control ceremonial knowledge. The Acoma are governed by the highly respected chief priest or cacique who "directly regulates the religious life of the Pueblo and indirectly controls secular governance through his appointment of the Council" (Holmes 1989, 12). The Acoma have their own system of government, and the entire reservation is within tribal jurisdiction. Jobs are often sought in towns outside the reservation, and modern American culture continues to influence the traditional culture.

## Zuni Pueblo

Zuni peoples claim ancestral ties to the Zuni-Cibola region.<sup>36</sup> Although these ties do not include much

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36. The Zuni-Cibola region extended from the upper watersheds of the Puerco River of the West and the Pueblo Colorado Wash to the San Francisco Peaks, southward to the Mogollon Rim and the upper Gila River, eastward to the Magdalena Mountains, and thence along the southern and western edge of the Grants lava flow (Holmes 1989, 7-8).

of the lava flows of El Malpais, the Zuni recognize and use some sacred places that are within the national monument. Archeologists have documented continued cultural development in the Zuni area from Basketmaker times forward, from early isolated pit houses to the large pueblo villages of the late prehistoric period. For example, the historic village of Hawikuh, 15 miles southwest of Zuni Pueblo, was "occupied from about A.D. 1300 to 1680 by the ancestors of the modern Zunis" and the Zuni valley has been "occupied continuously from an early period. ." (Woodbury 1979, 467).

Details of Zuni architecture and ceramics show influences from the Chaco Canyon cultural center to the northeast and from the Upper Gila regions to the south. These southerly influences may have had something to do with the language differences between the Zuni and their Keresean-speaking pueblo neighbors.

During the mid 1500s, Zuni contact with Europeans "began in violence" as the Zuni villages resisted the efforts of the Spanish to convert them and extract tribute or material goods to support Spanish missions and communities (Woodbury 1979, 469). Over the next 150 years, the Spanish built missions in the Zuni-Cibola area, and intermittent periods of friendly relations between these two groups were interspersed by hostilities. The missions were alternately abandoned and reoccupied, and Hawikuh mission was destroyed during the Pueblo Revolt of 1680. Following the uprising, the Zuni fled to refugee sites on defensible mesa tops, including Dowa Yalanne, known today as Corn Mountain. During the next decade, there were significant decreases in the refugee populations.

In 1692 the refugees gathered together and returned to Zuni Pueblo, leaving their other five towns vacant. Some of the complexities of social and ritual organization found in modern Zuni society may be due to this integration of previously independent towns as well as to the outside influences mentioned earlier (Woodbury 1979, 472). In 1820 the Spanish ended their mission efforts at Zuni, partly in response to continued Zuni resistance and partly because of increasing raiding by Apaches and Navajos.

An early, short-lived attempt by the Spanish to settle in the Zuni area had failed, and it was not until the 1860s that Spanish-speaking communities were established east of Zuni. During the mid

1800s, the Zuni established a more dispersed settlement pattern with summer farming villages in outlying areas with prime farmlands; eventually these became permanent year-round settlements. The coming of the railroad in the 1890s to Gallup, 40 miles north of Zuni, opened the region to a variety of outside influences.

Over the next 75 years, various churches worked to establish missions at Zuni, and the Bureau of Indian Affairs became increasingly involved in tribal affairs. During the 1900s, the Zuni Tribal Council "gradually increased in size and importance and came to achieve a dominant position in the political life of Zuni" (Woodbury 1979, 478).

Zuni, now the largest of the pueblos in the El Malpais region, has developed a strong educational system and built a crafts industry around the production of jewelry. Recent establishment of the Zuni-Cibola National Historical Park within the Zuni reservation paves the way for additional tourism in this area.

Despite these many outside influences, Zuni has managed to maintain its complex traditional world view in which social, religious, and political customs are strongly interconnected to the age-old ceremonial and religious cycles. The maternal household remains the "social and religious center of the family" (Ladd 1979, 482).

The Zuni-Acoma Trail (alternately the Acoma-Zuni trail) marks a centuries-old travel corridor between these two areas.

## Laguna Pueblo

Laguna peoples now reside in six major villages beyond Old Laguna, a large pueblo situated on a knoll overlooking the Rio San Jose. Some historians have speculated that Laguna Pueblo was founded in the last few years of the 17th century by refugees from several other Keresean-speaking pueblos, and that Acoma people were among the original settlers at Laguna. Other researchers point to traditional interpretations of both Acoma and Laguna origins and to archeological findings, noting that the peoples who call themselves Laguna were in this area before the arrival of the Spanish. In either case, "it is impossible to discuss the prehistory and legendary history of Laguna without considering that of Acoma" (Ellis 1979, 439).

Before A.D. 1400, the Acoma-Laguna area stretched from the Rio Puerco on the east to the Zuni Mountains on the west, and north to south from Mount Taylor to Alamocita Creek and the Rio Salado. A cultural continuum of human occupation in this area can be traced for hundreds of years; culturally this area was peripheral to developments in the nearby Anasazi areas and in the Mogollon region to the south. Mesa Verde peoples may have had an important place in the prehistory of both the Acoma and the Laguna, especially in the 14th century occupation of the village of Punyama on the Rio San Jose.

Some survivors of the 1680 Pueblo Revolt moved first to Acoma, then later to Laguna lands where they settled. By this time the Laguna had begun to establish summer farming areas, and eventually these farms became year-round pueblitos (Ellis 1979, 441). During the 1700s and early 1800s, small Laguna family farms and ranches gradually grew outward gradually from Old Laguna until raids by Apachean groups put a stop to the expansion.

Spanish settlers preempted some of the southern Laguna herding lands after the mid 1700s and, as elsewhere, introduced the Catholic religion and Spanish culture. In the 1800s the Laguna farming areas, which used both dry farming and ditch irrigation, were again expanded, and permanent villages were established. Laguna social organization was much like that of Acoma, with matrilineal clans assuming importance in marriage and other secular functions. Religious activities were primarily the responsibility of the religious societies. Tribal leaders known as caciques governed the pueblo.

By the late 1800s, a number of Protestant missionaries had come to the pueblo. Several married into the Laguna community, adding a new element to the combined native and Roman Catholic religious influences. Acculturation pressures led to a major break in Laguna society, and the more conservative members of the pueblo moved away, disrupting the religious hierarchy of Laguna. This small group of traditionalists went to Isleta Pueblo, some of their members eventually returning to Mesita (a former farming village). This

break led to adoption of a constitution by which Laguna is still governed (Holmes 1989, 15).

While still retaining a rich ceremonial and cultural identity, the Laguna today appear to be one of the most acculturated of the pueblos.

## The Navajo

There is no real consensus as to the exact date the Apachean peoples now known as the Navajo reached this part of the Southwest, but their southward migration must have brought them into contact with puebloan groups not too long after A.D. 1300 (Brugge 1983,490). These migrants brought with them an economic dependence on hunting and gathering.

By the time the Spanish arrived in the Southwest, Apachean peoples occupied the lands surrounding the western pueblos. Extremely adaptable people, the Apaches de Navajo (the Navajo) acquired elements from the sedentary pueblo cultures – like agriculture, ceramics, and a more formalized political structure.

In the early 1600s, the Spaniard Benavides described Navajos as semi-sedentary peoples who planted corn and hunted for game, lived in “underground” homes in rancherias, and were efficient traders (Brugge 1983, 491). Benavides reported an encounter with the Navajo near the base of Mount Taylor, placing them in the vicinity of El Malpais early in the 1600s.

The Navajo “participated in the Pueblo Revolt of 1680 and shared in the captives taken” (Brugge 1983,491). However, as the Spanish reconquered the rebellious pueblos, puebloan survivors fled, some to camp among the Navajo. Eventually these puebloan refugees began to build more permanent homes among their Navajo hosts. By the 1730s, “the pueblito tradition flourished alongside that of the hogan . [and] the Dineta became the center of a cultural development that has no equal in Apachean history”<sup>37</sup> (Brugge 1983, 493). The Navajo had acquired horses and metal objects from the Spanish, and the Puebloan refugees introduced

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37. The Dineta is the upper portion of the San Juan River drainage where Puebloan refugees lived with their Navajo allies.

European items like cattle, sheep and wool, and peaches.

Drought and attacks by the Ute contributed to conflicts between the Navajo and the Puebloan peoples, leading to Navajo rejection of some elements of Spanish and Puebloan culture. Cattle and sheep herding were another matter. Herding gave the Navajo an advantage during warfare. These highly mobile resources -their herds – could be shifted quickly from place to place.

For the next century, warfare continued among the Navajo, Spanish, and Puebloan groups. Some historians have described the Navajo as hostile raiders against whom the Calvary had to protect the peaceful Spanish and pueblo inhabitants. Others understand that the Spanish may have precipitated much of the unrest and that the Navajo “were more sinned against than sinning” (Roessel 1983, 506). This period of warfare ended in 1864 with the defeat of the Navajo and their long forced march to Fort Sumpter, a 300-mile journey of “hardship and terror” (Roessel 1983, 513).

Four years later the Navajo returned to a greatly reduced homeland, now the Navajo Reservation. Seven of the returning families reestablished the Ramah band in the Ramah Valley. The Ramah Reservation was established by the tribe and federal government in 1931 from individual Navajo allotments and federal purchases and exchanges (Roessel 1983,520).

The fundamental social and economic unit of Navajo organization is the residence group, organized “around a head mother, a sheep herd, a customary land-use area, and sometimes agricultural fields” (Witherspoon 1983, 525). Cooperating family groups form an outfit that shares access to major resources.

The Navajo universe is orderly and composed of interrelated elements, each having its own place. When illness or trouble comes, it is important to the Navajo to know the traditional ways of performing ceremonies to restore harmony to this universe.

Today the Ramah Navajo constitute a chapter of the larger Navajo Nation. The Ramah Tribal Council

provides secular leadership for the community, and serves as official representative to the “Big Navajo” and to outsiders.

The only historic archeological sites in El Malpais that can be definitively traced to contemporary peoples are Euro-American and Navajo. Most of these consist of either homesites or stone corrals associated with sheep herding.

## Summary

El Malpais has been used by the Acoma, Zuni, Laguna, and Navajo tribes in a variety of ways for centuries.<sup>38</sup> Acoma peoples have strong ties to the land base that is now the national monument. El Malpais was a traditional winter sheep and cattle herding location in the second half of the 19th century. Once, Acoma had land tenure here, so there is more than the tie through traditional uses. Wild sheep were captured in the cones and lava flows. The Acoma farmed near San Rafael and in Cebolla and Cebollita Canyons. The Acoma-Zuni Trail has long been an important transportation, trade, and pilgrimage route. Acoma gather herbs and other plants and natural resources and maintain shrines in El Malpais. The area of the lava flows, including springs, hills, meadows, and lava features, figures prominently in Acoma legends, stories, and religious beliefs. Some geographic features were used to define Acoma boundaries. Because of its proximity to Acoma Pueblo and a continuum of traditional use the eastern portion of El Malpais along NM 117 is probably used most by the contemporary Acoma.

The Zuni grazed sheep and hunted deer through the Zuni Mountains. Several trails across the lava (including the Zuni-Acoma Trail) were important trade and pilgrimage routes. Bandera Crater and the Ice Cave are important in Zuni cultural traditions, and the Zuni collect pinon nuts and other natural resources in this area.

The Laguna herded sheep throughout the Zuni Mountains and the holes-in-the-wall of the lava flows. Although we know little of their contemporary gathering activities, it is assumed that they also gather medicinal plants and other resources.

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38. This summary is abstracted from Holmes 1989, 21 et seq.

Ramah Navajo gathering and other traditional activities, particularly the collection of pinon nuts, are more focused on the western portion of El Malpais, especially in the national conservation area.

The major ongoing land use of El Malpais by all four groups is religious.<sup>39</sup> While this use is, for the most part associated with shrines that are visited on a regular but occasional basis, there are probably additional but unidentified activities such as religious pilgrimages, locations for a variety of religious offerings, and collection of medicines and materials for religious offerings.

## HISTORIC RESOURCES

Although El Malpais is well known in the oral history of local American Indians, its written history begins in the mid 1500s with the journals of the Spanish conquistadors.<sup>40</sup> These explorers skirted the lava flows or “bad lands” in their far-flung search among New Mexico’s pueblos for mineral wealth and converts to Christianity. Over the next four centuries various explorers, settlers, and missionaries – including the Spanish, the Mexicans, and the Americans – came to this region.

After the first wave of Spanish explorers and soldiers came the priests who established missions at the pueblos. Later settlers were drawn by the generous land grants, or ranchos, a settlement pattern that was to characterize New Mexico for over two centuries.

In mid 1776, Franciscan friars Dominguez and Escalante started westward from Santa Fe hoping to find a good overland route to link New Mexico with the Spanish empire in California. Failing at this, they returned to Santa Fe on a route through the

Grants/El Malpais area. This expedition is memorialized as the present-day Dominguez-Escalante Trail.

Following the Louisiana Purchase, the United States became embroiled with the Spanish over boundaries. Eventually Mexican citizens declared independence from Spain, and New Mexico became part of the Republic of Mexico. It was only a short time before the Santa Fe Trail and all its new trading opportunities opened a major transportation corridor between the United States and the Mexican Territory.

However, Mexican control over the area was short-lived, ending with defeat in the Mexican-American War of 1846. With the treaty of Guadalupe Hidalgo, New Mexico became part of the United States, abruptly terminating “more than 300 years of Spanish-speaking control of New Mexico” (NPS, Mangum 1988c, 22).

It was only a short time before American military expeditions began to explore the Southwest. Scientists, surveyors, and explorers like Simpson, Sitgreaves, Whipple, and Beale traversed the grassy valley between the slopes of Mount Taylor and the northern sections of El Malpais. Following old Spanish and Indian roads, they pioneered the 35th parallel route for future highways and railroads westward to California. This transportation corridor skirted the lava flows and mountains and followed the all-important springs and other water sources.

Today only traces remain of these early roads. One cuts through the central portion of section 7 south of the proposed multiagency center site. Others are obliterated by the Santa Fe Railroad, I-40, and old US Highway 66.<sup>41</sup> I-40 is the most recent adaptation of the old travel routes.

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39. Some geological features and geographic areas are important to native Americans. These landscape features may be shrines or special spiritual places – places described in creation stories or illustrating events in mythological times. Some places also hold an element of danger – like burials, major ceremonial sites, and Navajo sweat houses. Other places are important because of special natural materials, plants, animals, dyes, herbs, etc. Pilgrimage trails and ancestral village sites are sensitive to native Americans as well.

40. The following discussion is abstracted from Mangum’s 1988 history of occupation in the El Malpais area (NPS 1988c).

41. This corridor is also described as the Northern Arizona Transportation Corridor, map 3.1, in the **Comprehensive Plan for New Mexico’s Statewide Architectural Survey, A Five-Year Plan** (Hicks et al. 1985, 84).

American settlement did not immediately follow the early expeditions and roads. Navajo and Apache raiding prompted nearly 25 years of American military activity in the Southwest. Forts were garrisoned and cavalrymen were sent out to chastise the raiders. One of these forts was Fort Wingate, built in 1862 in the "lava-filled Ojo del Gallo valley where two major thoroughfares -the old military road to Fort Defiance and the old Spanish highway to Zuni – intersected" (NPS, Mangum 1988c, 35).

After the long tragic walk to Bosque Redondo, the Navajo returned to reservations, and Fort Wingate was closed. Establishment of reservations effectively opened this part of New Mexico to settlement despite prior claims to the land by various American Indian groups.

In 1869 the village of San Rafael arose close to the site of old Fort Wingate. Many of San Rafael's first residents were ex-military people and Spanish-Americans who began developing the area into an agricultural and sheep ranching community. As San Rafael prospered, other homesteads and communities were built, including Ramah which was settled by Mormon pioneers in the late 1870s.

In 1873 the valley north of El Malpais was surveyed for the railroad. As the rails moved west, small communities such as Grants grew up to serve as supply stations. Grants did not die out as did many of the other villages; instead a post office and a trading post were established. Eventually Grants became an important shipping point. By the late 1880s, vast acreages of land in the vicinity, purchased from the railroad land grants, had become large sheep ranches. These large ranches in and adjacent to El Malpais included the Telles, Chavez, Barela, and Mirabel holdings. The Mirabels owned or leased over 250,000 acres of land in the vicinity of **Bandera Crater**.

These large landowners leased out herds under a system of "partidos" -where the lessee supervised the herds and returned to the landowner "his original herd plus a percentage, with the lessee retaining possession of the remainder" (NPS, Mangum 1988c, 53). Numerous Basque herders took advantage of the **partido** system, and "at the height of the sheep industry, 1880 to 1925, scores of sheep camps dotted. . . the malpais" (NPS, Mangum 1988c, 53). Historic photographs show

herders, tents, and flocks of sheep in the vicinity of **Bandera Crater**.

During the late 1880s, the cattle industry began to inroads into the region (NPS, Mangum 1988c, 53). The Arizona Cattle Company purchased a huge acreage south and west of the badlands from the Atlantic and Pacific Railroad. The Cebolla Cattle Company and the Acoma Land and Cattle Company acquired land east of the badlands and west of Grants at Bluewater, and the Zuni Mountain Cattle Company bought lands and began operations in 1892. The cattle and sheep industries continued to expand until the severe droughts of the 1890s and the Panic of 1893 forced cutbacks. However, large operations still have holdings in and around El Malpais.

Timber was first harvested from the Zuni Mountains to build Fort Wingate; when the railroad came through this area, hundreds of ties were supplied from the Zuni Mountains. In 1890 the short-lived Mitchell Brothers Lumber Company, in cooperation with the Atlantic and Pacific Railroad, built a spur railroad (the Zuni Mountain Railway) into the Zuni Mountains to move the timber out to the main line. American Lumber acquired the defunct Mitchell Brothers operation in 1903 and for a time shipped an average of 100 carloads of logs per day eastward to their sawmill and planing plants in Albuquerque.

The logging industry in the Zuni Mountains operated until the Great Depression. In the early 1930s, Grants businessmen leased and operated one of the big timber operations in the Zuni, working the area around **Paxton Springs** (a few miles northwest of **Bandera Crater**). As major timber areas were exhausted, operators moved south and west into previously uncut areas, including the **Bandera Crater** area. Revived briefly after World War II, the timber industry eventually reverted to small individual operators with portable sawmills who continued to operate in the area.

The proposed **Bandera** visitor center is to be built near the badly deteriorated remains of several cabins once associated with a 20th century lumbering operation, probably the **Breece** Lumber Company. These hastily erected cabins, known as Bill Morgan's Camp, had dirt floors and were intended for temporary shelter only. Apparently they were used about six months before abandonment

(Neil Mangum, personal communication, April 5, 1989).

The cut timbers and piles of sawdust closer to NM 53 in the **Bandera** area were a small sawmill that postdated World War II. The mill lasted for about six or seven years, producing boxcar liners and railroad ties from logs purchased from David Candelaria (Neil Mangum, personal communication, April 5, 1989).

The 1916 Homestead Act, the railroad, and the thriving timber industry at Grants all worked together to increase the number of homesteads on the periphery of the badlands. Completion of the Bluewater Dam and Irrigation Reservoir in the late 1920s opened additional arid lands to settlement.

During the Great Depression, “the eastside of the malpais became dotted with new arrivals” who erected simple dugouts, or timbered or poled houses, built on stone foundations uprooted from nearby prehistoric sites (NPS, Mangum 1988c, 60). However, the dryland farming was seldom profitable, and many of the settlers moved on before the three-year homestead period was up. Many of these homesteads are still visible today, some in the vicinity of the Sandstone Bluffs.

During the 1920s and 1930s, the sheep and cattle business was plagued by low prices, overgrazing, and disease, forcing many small ranchers out of business. With the declines in the cattle, sheep, and lumbering industries, agriculture and mining began to assume more importance in the region. Produce farms grew up west of Grants. New mining activity included fluor spar mines along the west side of the badlands as well as pumice extraction operations north of Grants.

During World War II, 9 square miles of the badlands (centered on **McCartys Crater**) were reserved as a bombing practice range for planes from Kirtland Air Force Base in Albuquerque. Following the war, this area was restored to the public and private sector, and efforts were made to remove all unexploded ordnance.

The local landmark of Kowina along NM 117 is another reminder of the area’s past. Development in this area, spearheaded by ranchers Mark and Ina Elkins and Artie Bibo, honored “the western pioneers, and the rich, proud heritage of the Acoma Indians” (NPS, Mangum 1988c, 72). The facility and

surrounding land, on a mesa just east of NM 117, were sold in about 1980 to the Acoma Indians.

The discovery of uranium propelled Grants into a period of growth, which peaked between 1960 and 1980. Since then, the lessened demand for uranium has been reflected in the Grant’s economic downturn.

Since the 1930s, the tourist industry has steadily grown in the Grants area. Construction of major transcontinental highways across northern New Mexico, first US 66 (hard-surfaced during the 1930s) and later I-40, helped popularized major tourist attractions like **Chaco Canyon**, **Petrified Forest**, and **Grand Canyon**. As early as the 1920s, the custodian at El Morro urged the preservation of the Ice Cave at **Bandera**.

Early efforts to include the Ice Cave and **Bandera Crater** in the national park system failed, so local rancher and businessman Sylvestre Mirabel acquired the Ice Cave and leased it to homesteader Cecil Moore. By October 1938 Moore had upgraded the narrow, rough path to the Ice Cave and replaced the crude tree-trunk ladders with a wooden stairway.

Envisioning a dude ranch, Moore built a “series of rustic cabins, restaurant, service station, and bar to cater to the motoring public” (NPS, Mangum 1988c, 71). Moore operated the business for less than four years; eventually the ownership passed to Mirabel’s daughter, Prudenciana Candelaria. During World War II the Ice Cave was sporadically opened for tourists. In addition, the development was used briefly as a cowboy camp. Candelaria’s son David and his wife Cora have managed the cave since 1946. Electricity was installed in 1955, and NM 53 was paved in 1966, making it easier for tourists to reach the cave and adjacent crater.

Today the Candelaria trading post complex includes approximately 13 log structures built at the base of **Bandera Crater** among scattered islands of rough black lava in an open forest of ponderosa pine. The metal-roofed log cabins and larger log trading post are grouped around an irregularly shaped parking area paved with crushed black cinder. Wood-rail fencing separates the parking area and the cabins. There is a small picnic area southeast of the parking area. A crushed cinder path leads from the trading post to covered wooden platforms and steps down into a large cavern -the

commercial Ice Cave – whose inner cavity is filled year-round with ice. Another wide cinder trail winds gently across the southern slope of Bandera Crater and circles into its deep interior crater.

Four of the log cabins and trading post building were in place by 1939; the other cabins were constructed later. Across the entrance road east of the trading post is a newer cabin that was moved in within the last two decades. Northwest of the trading post are two rustic frame outhouses.

The cabins and trading post are constructed of peeled round logs with square lock-notched corners. Horizontal joints are chinked with a combination of mud plaster and more recent cement plaster daubing. Vertical board siding cloaks the upper gable ends of the walls. The cabin closest to the trading post on the southeast has a small, open, covered porch.

Corrugated metal, probably original material, covers the single gable cabin roofs and the intersecting "T" gables of the trading post. Both the cabins and the trading post have wood windows and doors.<sup>42</sup> The simple interiors have exposed wood logs; cabinetry in the trading post probably dates from its change in use from a restaurant to trading post.

The campground, since removed, was part of the original tourist/dude ranch facilities. Changes in management and in the nature of local tourism led to deletion of the service station, restaurant, and bar. Changes in tourism also led to the demise of the overnight tourist business at Bandera.

Unused for the last two decades, the older cabins have not been appreciably altered since their construction in 1939. The trading post and a 1946 cabin have been remodeled, but remain architecturally compatible with the rest of the complex.

The Ice Cave/Bandera Crater area is also important as a natural resource and has a long continuum of religious significance to American Indian groups. This complex is historically significant, possessing integrity of design, setting, and material.

Recorded historic archeological sites include transportation corridors, homesteads, and remnants of ranching operations (corrals, hogans, dugouts, cabins, wells, ovens, walls, and other structural remains and debris). Two sites are attributed to the Navajo; 11 others, probably Euro-American sites, date from around 1912 to the more recent past. These sites are found in the eastern part of the monument, in woodland and scrubland zones. When surveyed, four of the sites (including the Navajo sites) were intact: six had been vandalized, and three were eroded. Most sites are over 5,000 square meters in size. Consultations with the New Mexico State Historic Preservation Office indicate that the trading post complex at Bandera Crater is probably eligible for the National Register for its local significance in early New Mexico recreation and tourism, and for the traditional cultural importance of the Ice Cave and Bandera Crater to American Indians, especially the Zuni. Nomination forms are being prepared for this complex. No other properties within the monument are listed on the register or are presently being considered for listing.

## PREVIOUS CULTURAL RESOURCE WORK AT EL MALPAIS

The earliest studies of El Malpais resulted from military and civilian expeditions during the middle to late 1800s. The most important of these was Adolph Bandelier's reconnaissance survey through New Mexico from Arizona to the Rio Grande between 1880 and 1885. Bandelier may have used the Acoma-Zuni Trail to traverse the badlands on his westward journey. He inspected the Cebollita Mesa area and described the "ruins at Ventanas. . . [set] on a high ridge. . . [with] an immense dark malpais on the west" (Marshall et al. 1979, 187 and 192).

Most of the late 19th century and early 20th century archeological research occurred west of El Malpais near Zuni and El Morro, and it was not until the 1940s and 1950s that Dittert and Ruppe began their work around the west flanks of Cebollita Mesa, excavating and recording a number of sites.

Dittert's doctoral dissertation described a number of

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42. The cabins have six-light wood casement windows placed horizontally in a series of two or three. The trading post windows are wood, two-over-one light double-hung or horizontal six-light barn sash; a large single-light picture window has been added on the front.

sites in the western portion of the Acoma Culture Province, including Calabash ruins (known today as Kowina ruins). A major site farther south, in the national conservation area, was named for Dr. Dittert and is on the National Register of Historic Places.

Later surveys by the School of American Research in the 1970s covered about 7 square miles in the vicinity of Las Ventanas, a Chacoan outlier site that is also on the national register. More recently other surveys have been conducted on Cebollita Mesa in the adjacent conservation area by the Bureau of Indian Affairs and along the NM 117 by the Laboratory of Anthropology, Museum of New Mexico. A few isolated site-specific surveys were done by the Bureau of Land Management or their contractors.<sup>43</sup> More recent work is underway.

Unfortunately much of the early work was done before the advent of modern dating technologies and excavation techniques. Too often formal reports on excavations were never completed, and it has sometimes proved impossible to substantiate recorded site locations and definitions. Most of the recent surveys were done for compliance purposes – to clear specific, limited areas for development or new land uses. Given these constraints, the relationships among the various documented sites are difficult to assess.

Over the past century, hundreds of books and articles have been written on the Zuni, Navajo, Laguna, and Acoma peoples. The least amount of ethnographic information is on the Acoma and Ramah Navajo, the two groups whose lands are closest to the boundaries of El Malpais; many of the publications are out of date and do not account for the contemporary cultural condition. Documentation of past Indian land claims contains a great deal of information, but for the most part these data are difficult to research or are unavailable to researchers. An overview of these disparate sources is being completed by ethnohistorian Barbara Holmes. In her overview, short summaries drawn from existing literature describe general American Indian uses of El Malpais and tell some of the stories related to the lava flows.

Early historical accounts of encounters between American Indians and Euro-Americans are usually written from the latter's perspective and do not always provide an accurate understanding. Overall, the numerous history studies dealing with New Mexico devote relatively little space to the Grants area. The badlands were skirted by major transportation routes and most early Euro-American travelers. The area is sparsely settled, and only in recent times has it gained more recognition.

In past studies by federal agencies, short discussions of the history of this region have focused on special features like the ice caves or upon activities like lumbering or mining. These sources, as well as public records, newspapers, maps, and personal interviews and other oral histories, have all been synthesized into an overview of the human occupation of El Malpais country by historian Neil Mangum (NPS, Mangum 1988c). Mangum's synthesis deals primarily with the history of the El Malpais region from the earliest Spanish explorations, and with some exceptions does not identify specific historic sites.

A brief cultural prehistory of El Malpais was completed in 1988 (NPS, Ireland 1988a). This document discusses some of the previous research in the area and summarizes the sequence from Paleo-Indian times through the final Pueblo periods and contact with the Spanish; it also gives statistical data on distribution of Anasazi and historic archeological sites.

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43. Much of the previous discussion was abstracted from Arthur K. Ireland's overview of the cultural prehistory of El Malpais (NPS 1988a) and from a description of Anasazi communities by Marshall et al. (1979).

## SOCIOECONOMIC ENVIRONMENT AND VISITOR USE

### REGIONAL CHARACTERISTICS

#### Regional Setting – Overview

El Malpais National Monument is in west-central New Mexico, a relatively mountainous area east of the Continental Divide. The monument is just south of the city of Grants (elevation 6,520 feet) in Cibola County. Cibola County, which extends from Bernalillo County west to the Arizona border, is the newest of New Mexico's counties (created by the state legislature in July 1981). Three-quarters of the land in the pre-1981 Valencia County is now in Cibola County, and most of the statistical data that is available on Cibola County prior to 1981 has been extrapolated from pre-1981 Valencia County – including much of the available demographic data because Cibola County was created after the 1980 census.

El Malpais is about 75 miles west of the Albuquerque metropolitan area, the most populated region in the state. Other major population centers within two hours drive of the monument include Santa Fe (135 miles east-northeast) and Gallup (60 miles west). The Arizona state line is about 70 miles west of the monument.

With a population of about 4,200, the Pueblo of Acoma adjoins the monument on the east. The Ramah Navajo Reservation, which has a population of about 2,000, is west of the monument. The Laguna and Zuni Indian reservations are each within 40 miles of El Malpais, Laguna being due east and Zuni being due west.

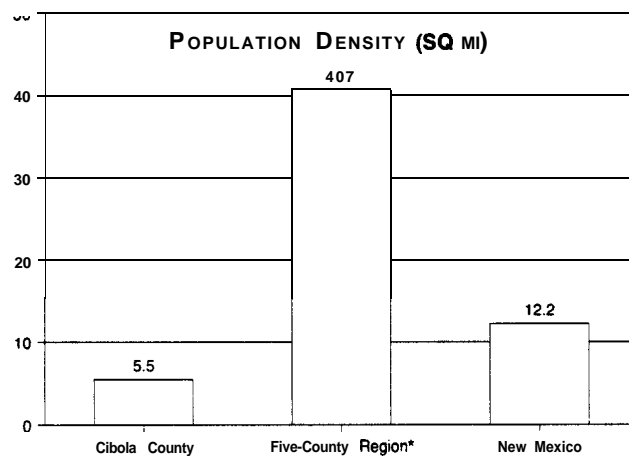
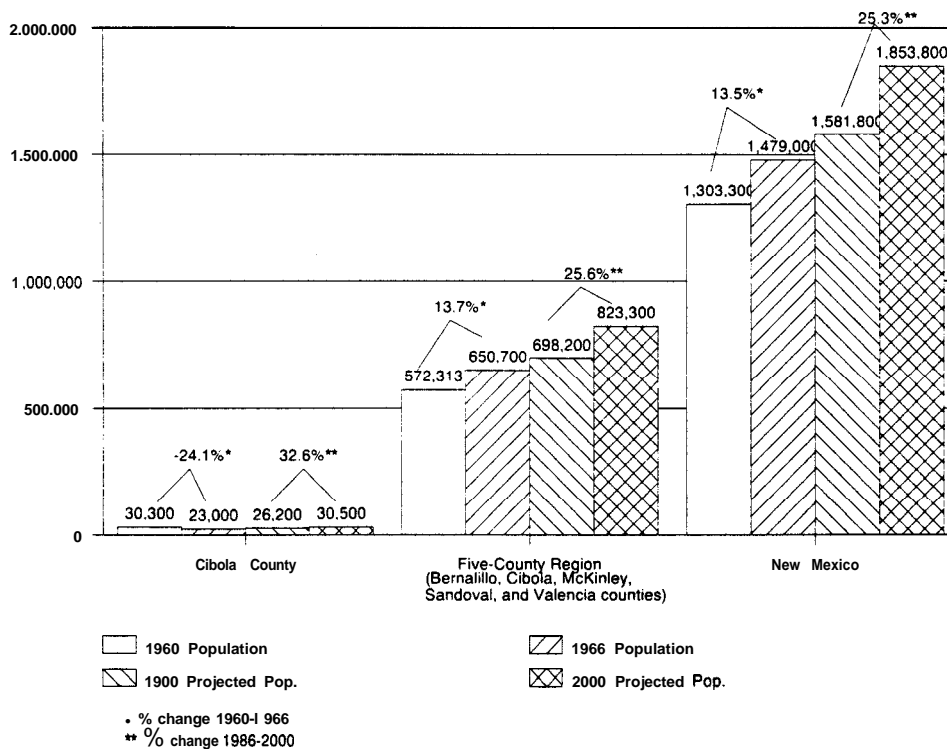
#### Population

The city of Grants and Cibola County have each experienced a significant decline in population over the past decade. The population of Grants has decreased from 11,439 in 1980 to 8,520 in 1986 (a 26 percent loss); Cibola County's population has decreased by 7,300 people in the same period (a 24 percent decrease). Much of this loss is directly attributed to the sharp decline in the demand for uranium ore, which was the mainstay of the local economy during the 1960s and early 1970s.

The region surrounding El Malpais National Monument has experienced a 13.7 percent increase in population since the 1980 census. This region (which includes Bernalillo, Cibola, McKinley, Sandoval, and Valencia counties) accounts for 44 percent of New Mexico's population. Much of the population gain in the region (about 9.4 percent) can be attributed to the city of Albuquerque, the seat of Bernalillo County. The state of New Mexico has experienced a similar gain in residents (13.5 percent) over the same period.

It is believed that Cibola County has reached the end of its period of population loss. The population of the county has stabilized and is expected to increase by nearly one-third by the year 2000, returning the population to a level comparable to before the downturn in the uranium industry. The region and the state are both expected to realize similar gains in population over remainder of the century. Figure 1 summarizes population dynamics for Cibola County, the five-county region, and New Mexico.

**FIGURE 1: POPULATION STATISTICS FOR AREAS SURROUNDING EL MALPAIS NATIONAL MONUMENT**

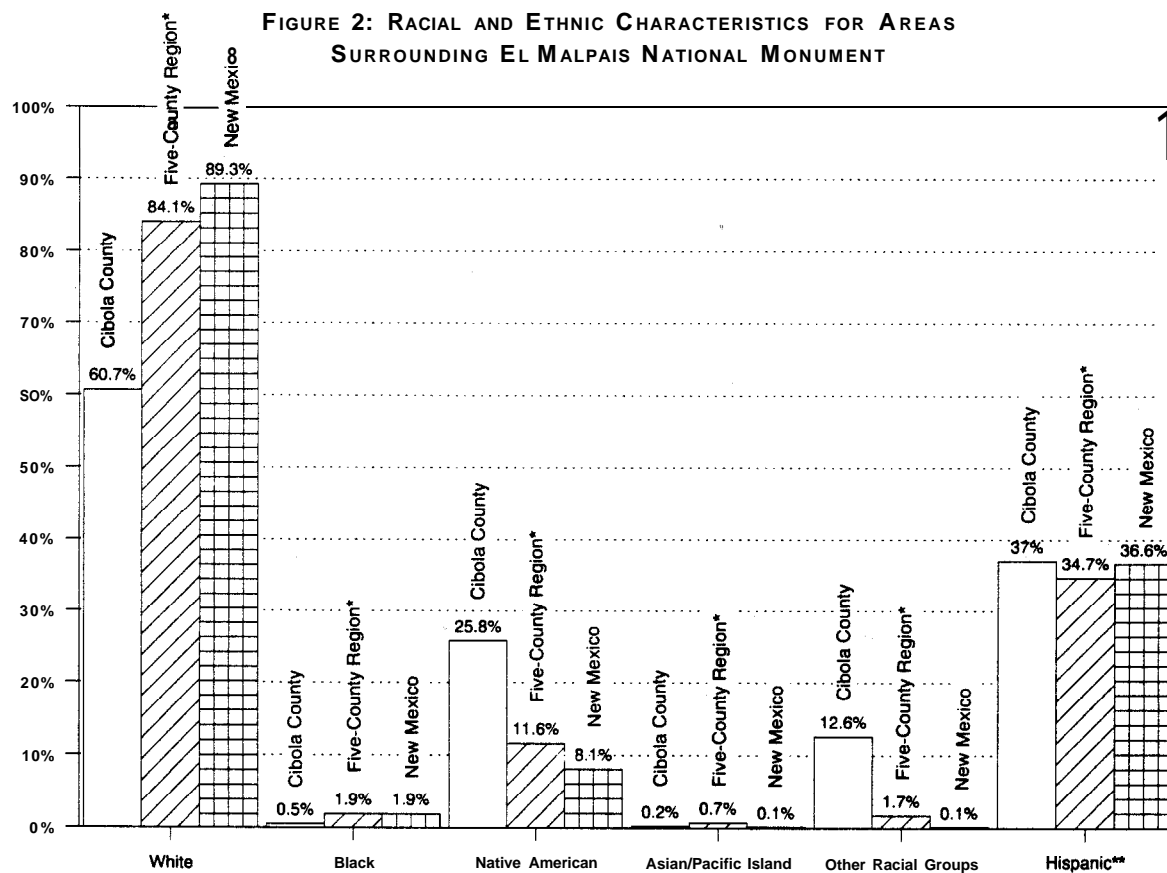


Source: Bureau of Business and Economic Research, University of New Mexico

\*Of the regional growth, 9.4 percent can be attributed to Bernalillo County, which includes the Albuquerque metro area.

Although the racial composition of Cibola County is primarily white, many American Indians also reside in the area. The pueblos of Acoma and Laguna are both within the county. Hispanics are a predominant ethnic group throughout New Mexico, accounting for over one-third of the state's population.

Thirty-seven percent of Cibola County residents consider themselves to be Hispanic. Figure 2 summarizes the racial and ethnic characteristics of Cibola County, the five-county region, and the state.



Source: New Mexico Department of Labor

\*Five-county region includes Bernalillo, Cibola, McKinley, Sandoval, and Valencia counties.

\*\*The Hispanic community crosses several of the above racial groupings.

## Economy

At the southern edge of the uranium belt, the city of Grants was once known as the "uranium capital of the world." However, a severe drop in the uranium market in the late 1970s caused a loss of over 4,000 jobs in the area. The only remaining substantial uranium operation in the region is the Chevron mine near San Mateo (about 15 miles north of Grants), which employs about 400 people.

Since the decline in the uranium market, the city of Grants and Cibola County have made a concerted effort to diversify the area's economy. Local agencies such as the Greater Grants Industrial Development Foundation and the Greater Grants Chamber of Commerce have attempted to bring new business and industry to the area. The efforts of these agencies have been successful, having attracted several small industries to Grants.

The state has also contributed to the revitalization of the area, having recently located the New Mexico Western Correctional Facility (a women's prison) at Grants and a highway department district office near Milan.

Local, state, and federal governments are the principal employers in Cibola County, employing over one-third of the nonagricultural wage and salary work force. The wholesale and retail trade sector accounts for an additional 23 percent of the work force. Unemployment in Cibola County totaled 13.4 percent in June of 1988 (compared to 8.7 percent for New Mexico during the same time period); however, unemployment in the county is down from levels that exceeded 20 percent during the decline of the uranium market. Figure 3 summarizes total nonagricultural employment for Cibola County, the five-county region, and the state.

The average per capita income for Cibola County in 1986 was \$7,253. This figure is lower than the state average (\$11,435) and the five-county region average (\$12,236). Average per capita incomes for other individual counties in the five-county region include: Bernalillo (\$13,472), McKinley (\$6,960), Sandoval (\$11,082), and Valencia (\$10,436).

The retail trade sector contributed the largest share of the total gross receipts for Cibola County in 1987 (over \$83 million). Total gross receipts for Cibola County in 1987 exceeded \$164 million. (This figure does not include gross agricultural receipts, which

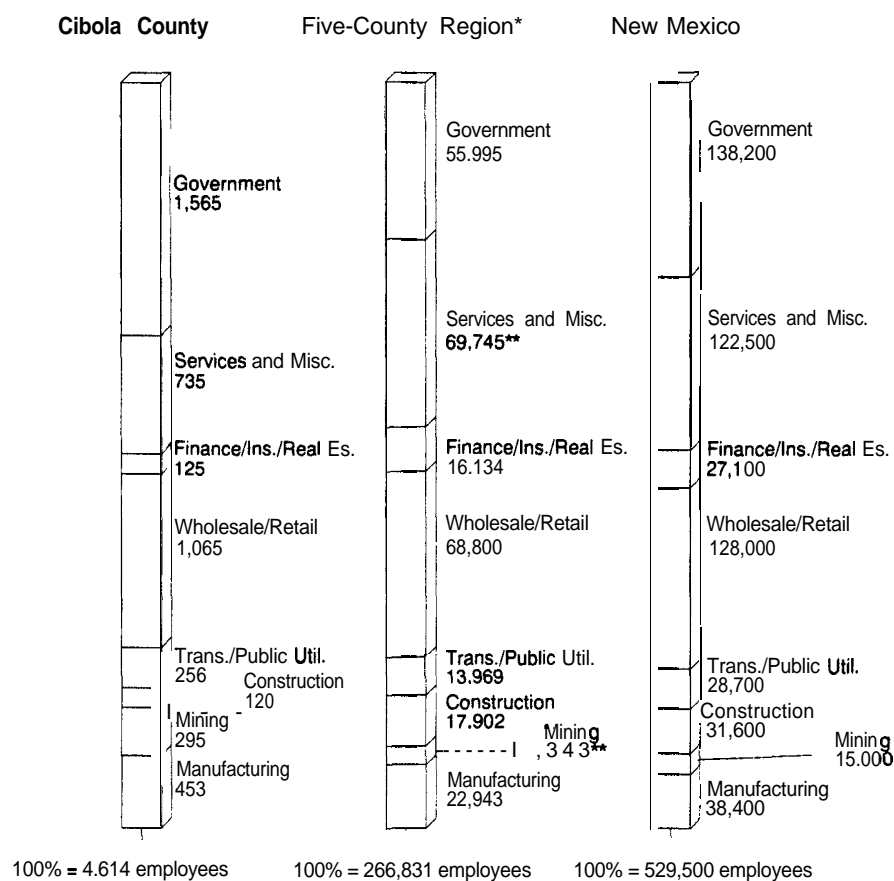
are not yet available for the county for 1987; however, agriculture cash receipts for Cibola County in 1986 were \$8 million, most of which was attributable to livestock production.) Table 8 summarizes total gross receipts for all sectors of Cibola County's economy for 1987.

Tourism is an integral component of Cibola County's economy. In 1986, 437 individuals were employed by lodging or eating/drinking establishments in the county. Gross receipts of hotels, motels, trailer parks, and other lodging places totaled over \$3 million in 1987. Gross receipts for eating and drinking places totaled over \$10 million during the same period. The city of Grants collected almost \$86,000 in lodger tax receipts during its fiscal year 1986-1987.

## Transportation/Access

Grants and El Malpais National Monument are easily accessible by automobile, with one interstate highway and two primary state highways passing through the area. Interstate 40 (I-40), the major east-west thoroughfare from Oklahoma City to Los Angeles, is immediately south of Grants. The proposed multiagency center will be just south of the interstate at the east Grants exit. The current combined adjusted average daily traffic (AADT) for the two exit ramps at this interchange is more than 1,700 vehicles per day. The AADT for I-40 just east of Grants was 12,510 vehicles per day in 1986. Peak monthly traffic volumes occur on this stretch of highway from June through August. During this period, approximately 15,000 vehicles per day pass through the area. February is the month with the lowest adjusted average daily traffic (about 9,500 vehicles per day).

**FIGURE 3: EMPLOYMENT FOR AREAS SURROUNDING EL MALPAIS NATIONAL MONUMENT — 1987  
(NONAGRICULTURAL WAGE AND SALARY EMPLOYEES)**



Source: U.S. Department of Commerce, Bureau of Census, 1980

\*Five-county region includes Cibola, Bernalillo, McKinley, Sandoval, and Valencia counties.

\*\*Valencia County mining employment was included under the services and miscellaneous sector rather than under the mining sector.

**TABLE 8: GROSS RECEIPTS FOR MAJOR ECONOMY SECTORS  
CIBOLA COUNTY – 1987**

Sector	Receipts (\$000s)
Retail Trade	\$ 83,016.2
Transportation, Communications, & Utilities	30,338.6
Construction	18,984.9
Services	14,942.1
Wholesale Trade	9,357.8
Manufacturing	5,846.9
Finance, Insurance, and Real Estate	1,404.9
Mining	<b>860.3</b>
Agricultural*	8,009.0*

\*1986 receipts, most of which were from livestock production. Agricultural receipts for 1987 were not available.

Sources: New Mexico Taxation and Revenue Department and New Mexico Agricultural Statistics Service

New Mexico Highway 117 (NM 117), sometimes used as a short-cut from Albuquerque to Phoenix, runs roughly parallel to the eastern boundary of the monument. Access to this highway is gained by way of I-40 just east of the Grants city limits. AADT on NM 117 was 206 vehicles per day in 1986 (measured at the interstate). AADT on this road tapered to 84 vehicles per day at the York Ranch (near the southern limit of the monument).

New Mexico Highway 53 (NM 53) skirts the western edge of monument and enters Grants near the western city limit. The highway is used by many as a route to El Morro National Monument (about 20 miles from the western boundary of the El Malpais National Monument). AADT on NM 53 was 3,482 vehicles per day at the Grants city limit in 1986. The traffic decreased to 409 vehicles per day at a point approximately 24 miles south of Grants.

NM 53 and NM 117 are connected by Cibola County Route 42 (Route 42), an unimproved dirt route that passes through the national conservation area south of the monument. The road enters the boundaries of the monument near its intersection with NM 53 just west of Bandera Crater. Route 42 receives limited use, and is periodically impassable because of muddy conditions.

Commercial air transportation to the area is through airports at Albuquerque and Gallup. Several major carriers service the Albuquerque airport, while only commuter service is available to Gallup. AMTRAK also provides passenger rail service to both Albuquerque and Gallup. Greyhound and Trailways provide commercial bus service to Grants.

### **Regional Visitor Services**

A full range of visitor services is available in the greater El Malpais area. Visitors to the area can find lodging, restaurants, gasoline and automobile service, and many other necessities in the town of Grants. A short drive to either Albuquerque and Gallup gives tourists an even greater range and number of services.

Lodging is ample in Grants and the surrounding area. Grants has 15 motels that have a combined total of over 800 rooms. An additional 109 inns and 102,000 rooms are available in Albuquerque and Gallup. For those who prefer camping to indoor lodging, 27 public and private campgrounds are within an 80-mile radius of El Malpais. These campgrounds, which range from primitive to modern, have a combined total of almost 1,500 sites.

The city of Grants supports more than 30 restaurants, as well as numerous gasoline stations and gift shops. Other businesses in town include grocery and convenience stores, clothing shops, sporting goods dealers, and banking institutions.

A broad range of medical services is available in Grants. Medical resources include a 43-bed public hospital, which provides a comprehensive range of services (including ICU/CCU and neonatal care). A number of physicians, dentists, and optometrists practice in the Grants area. Emergency medical transportation is also available.

## REGIONAL RECREATION RESOURCES AND USE

El Malpais National Monument is part of a geographically extensive network of unique southwestern parklands that will soon be connected by a formally designated automobile touring route known as the Masau Trail. Visitors to the I-40 multiagency center will receive a general introduction and orientation to trail facilities. The legislation establishing the monument specifies that the trail will link El Malpais to El Morro National Monument, Chaco Culture National Historical Park, Aztec Ruins National Monument, Canyon de Chelly National Monument, Pecos National Monument, and Gila Cliff Dwellings National Monument. Public Law 100-567 (October 31, 1988) provides for the addition of Zuni-Cibola National Historical Park to the network of facilities connected by the trail. Other sites of national significance may be added to the network from time to time under guidelines in the legislation and in the plan being prepared for the trail. The Masau Trail plan is currently being prepared by the NPS Southwest Regional Office. In addition to providing the overall management framework for the trail, this plan includes a conceptual marketing plan and strategy that will promote public awareness of the trail and its sites on a regional, national, and international level.

The area surrounding El Malpais encompasses many recreation lands and facilities. Most of these lands have as their base the rich natural and cultural resources of west-central New Mexico. A brief description of some of the recreation attractions in the El Malpais area is presented below.

The **New Mexico Museum of Mining** in Grants interprets the history of uranium mining, which was very important in the development of western New Mexico. Visitors are able to descend underground and take a guided tour of a replicated uranium mine.

The **Pueblo of Acoma**, also known as **Sky City**, is 22 miles east of Grants and 13 miles south of I-40. The pueblo is the oldest continually occupied Indian village in the United States, dating back to the mid 1100s. Access to Sky City, which is on a high mesa, is by bus tours from the base of the mesa; guided tours are offered daily.

**Cibola National Forest** provides myriad recreation opportunities for visitors. One of the most popular areas is Mt. Taylor, just northeast of Grants. The peak is about 11,300 feet in elevation and can be seen from several locations within the monument. Hiking, hunting, cross-country skiing, and snowshoeing are a few of the activities available in this area. The U.S. Forest Service also manages five developed automobile campgrounds within the national forest.

**El Morro National Monument** is about 20 miles west of El Malpais National Monument and is accessed by way of NM 53. The monument is best known for Inscription Rock, an impressive sandstone escarpment that contains numerous historic engravings dating as far back as the early 17th century. The monument also includes ruins of ancient pueblos. Limited picnicking and camping occur within the monument.

Twelve miles west of Grants, **Bluewater Lake State Park** provides opportunities for water-based recreation as well as camping and picnicking. Swimming, fishing, boating, and waterskiing are among the most popular activities. The lake is stocked with rainbow trout and catfish, and it is one of the most popular trout-fishing lakes in New Mexico. **Bluewater Creek State Park**, a new addition to the New Mexico state park system, is on the southwest shore of the lake.

Other recreation areas and visitor attractions near El Malpais include the Zuni Pueblo, the Laguna Pueblo, the Ramah Navajo Reservation, Chaco

Culture National Historical Park, Red Rocks State Park, and the Apache National Forest. The Continental Divide Trail, an extensive recreation trail that is currently in the planning stages, will pass through or very close to the monument and the national conservation area.

Private campgrounds and RV parks are numerous in the El Malpais region. Within 80 miles of Grants there are 16 private campgrounds (1,150 campsites). State park, national forest, and NPS campgrounds in the area (80-mile radius) add another 354 sites to this total. Table 9 lists public campgrounds within the area, together with the nearest city or town and the number of campsites available at each facility.

The cities of Albuquerque, Santa Fe, and Gallup also provide a wide range of recreation facilities and opportunities.

Thousands visit the parklands and tourist attractions of the El Malpais area every year. Table 10 summarizes the number of these visits recorded at selected public recreation areas in western New Mexico in 1987. Most of these areas have been steadily growing in visitation in recent years, having

rebounded from declines that paralleled the shortages and high price of motor fuels in the late 1970s.

Although the land now in El Malpais National Monument has supported a variety of recreation uses for a number of years, almost no data exists about the current or historic visitor use. Traditional recreational uses include four-wheel driving, hiking, cave exploration, bird-watching, photography, and nature study. Visitor use projections for the monument and national conservation area are presented in the following section.

A feasibility study is being conducted concerning the development of a tourist railroad that would link Grants to the west side of the monument. This railroad would follow the route of the historic Zuni Mountain Railroad Company from Grants, through the Zuni Canyon, to the area of **Bandera Crater**. The completion date for the feasibility study is April 2, 1990. There is considerable political and community support for this project. A broad range of interests and agencies will be involved in the study and in any subsequent development.

TABLE 9: PUBLIC **CAMPGROUNDS IN THE EL MALPAIS AREA**  
(WITHIN AN 80-MILE RADIUS)

<u>National Park Service</u>	<u>Nearest Community</u>	<u>Campsites</u>
Chaco Culture National Historical Park	Crownpoint	45
El Morro National Monument	Ramah	9
<u>New Mexico State Parks</u>		
Bluewater Lake	Bluewater	60
Bluewater Creek	Bluewater	6
Red Rocks	Gallup	95
<u>U.S. Forest Service - Cibola National Forest</u>		
Canyon Lobo	Grants	<b>9</b>
Coal Mine	Grants	21
Ojo Redondo	Bluewater	20
Quaking Aspen	McGaffey	20
McGaffey	McGaffey	49
<u>U.S. Forest Service - Apache National Forest</u>		
Quemado Lake	Quemado	20

**TABLE 10: VISITATION AT SELECTED NEW MEXICO RECREATIONAL FACILITIES — 1987**

**New Mexico State Parks**

Bluewater Lake	182,100
Bluewater Creek	10,500
Coronado	201,300
Fenton Lake	159,500
Red Rocks	101,500
Sen. Willie Chavez	71,400

**United States Forest Service**

Canyon Lobo	7,000
Coal Mine	24,700
Ojo Redondo	10,600
Quaking Aspen	23,500
McGaffey	26,000
Quemado Lake	25,000

**National Park Service**

Chaco Culture	
National Historical Park	58,000
El Morro National Monument	56,400

**VISITOR USE PROJECTIONS FOR EL MALPAIS**

Because of the lack of data on existing or past recreation use levels at El Malpais, it is not possible to estimate future visitor use by means of a linear projection of historic statistics. Thus, it was necessary to adopt a different methodology to forecast the level of use that might be expected at the monument.

The methodology selected was comparative capture rates. This approach allowed for the estimation of possible visitation by means of comparison to other areas with similar features and resources and/or similar physical locations. A "capture rate" is the relative percent of motor vehicles that enter a recreation area from an adjacent or nearby roadway. When capture rates are used to predict visitation for a new monument such as El Malpais, careful consideration must be given to the areas selected for comparison. The most accurate forecasts result when the indicator areas are highly similar to the area being predicted.

The parks to be compared to El Malpais National Monument were selected based on two criteria: the primary resource emphasis of the park (i.e., natural, cultural, geological, etc.) and the physical location of the unit (region of the country, relationship to population centers and transportation routes, etc.). Also, because the monument is a unit of the

national park system, only existing NPS facilities were considered for comparison.

Because a principal attraction of the monument is its geological features, this type of resource was considered a primary indicator in the selection of comparison parks. The monument also has a wealth of cultural resources, another important consideration.

A second primary indicator used was the physical location of the areas. Recreation areas selected were proximate to both a large metropolitan area and a major transportation route that supports high average daily traffic.

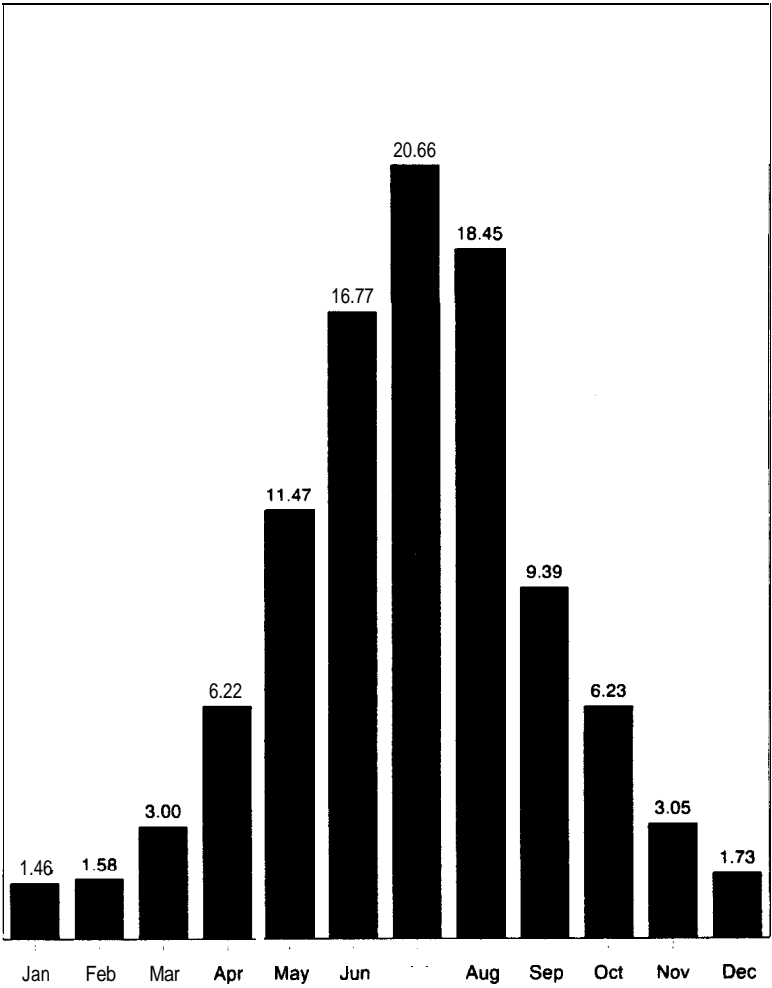
Based on these criteria, nine NPS units were selected for comparison to El Malpais National Monument — eight of which are in the southwestern United States (either New Mexico or Arizona). Most of these units are near a major freeway and/or population center. El Malpais National Monument was most similar to units with capture rates in the range of 1.1 to 2.2 percent. Thus, a capture rate of 1.6 percent was used in projecting visitation for the monument, with 1.1 percent and 2.2 percent being used for low and high range estimates.

Recreation visit forecasts have been developed for El Malpais National Monument by year and by month. The seasonal distribution of recreation visits to the monument is based on a typical extended

summer use pattern. This pattern of use, summarized in figure 4, is characteristic of many NPS facilities in the southwestern United States. Examples of other regional park areas that exhibit this pattern include Aztec Ruins, El Morro, Walnut Canyon, Fort Union, Sunset Crater, Pecos, and Wupatki national monuments. Figure 4 depicts expected monthly use as a percentage of expected annual use. Monthly percentages represent the

average for all NPS facilities exhibiting this use pattern.

**FIGURE 4: SEASONAL VISITATION DISTRIBUTION PROJECTION  
FOR EL MALPAIS NATIONAL MONUMENT  
BY MONTHLY PERCENTAGE OF ANNUAL USE  
(TYPICAL EXTENDED SUMMER USE PATTERN)**

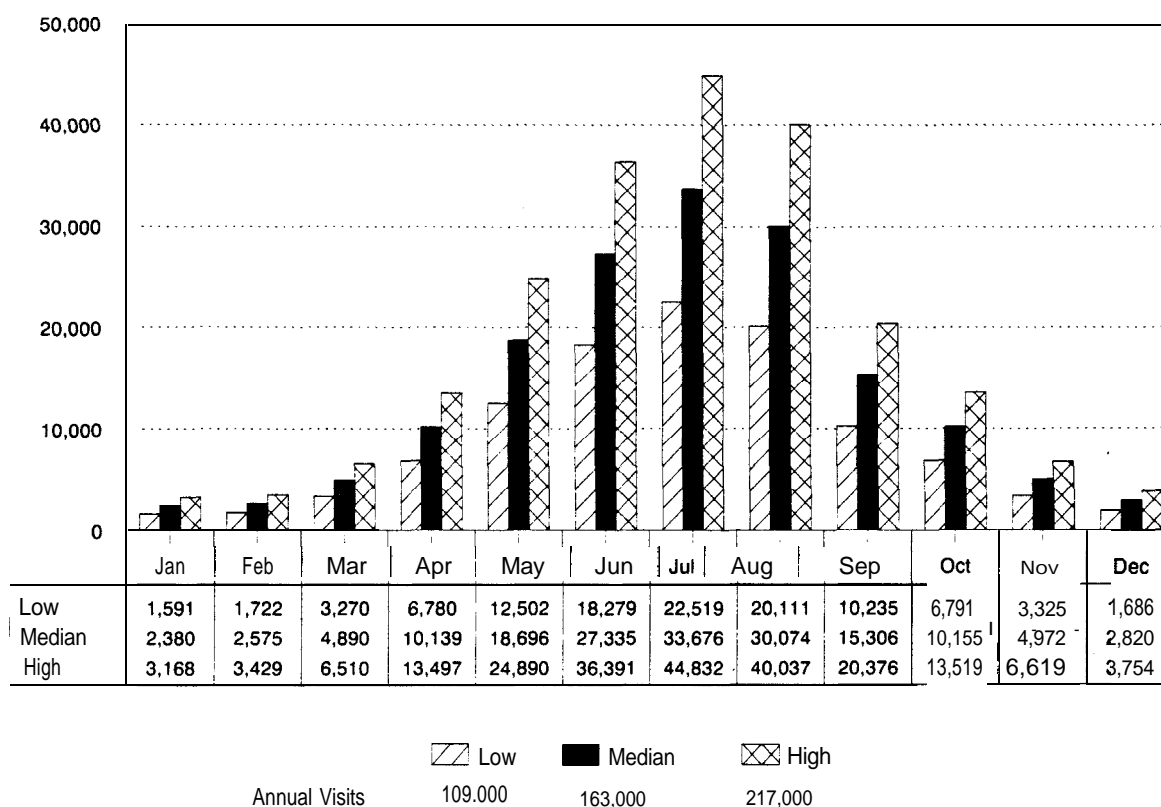


It should be noted that the preceding table reflects gross, overall use patterns. Different types of use may occur from month-to-month or season-to-season that vary somewhat from the above standard. For example, use of the monument by area residents may be concentrated in spring or fall periods, whereas use of the monument by

out-of-area recreationists may be concentrated in the summer months.

Based on the capture rates described above, figure 5 illustrates the possible range of recreational visitation for El Malpais National Monument that could occur by the year 1995.

**FIGURE 5: RECREATION VISITS FORECAST\***  
**EL MALPAIS NATIONAL MONUMENT/**  
**NATIONAL CONSERVATION AREA - 1995**  
**(BY MONTH)**



\*The calculations assume 2.8 people per vehicle, which approximates current trends observed by the NPS Statistics Office. A capture rate of .011 (low), .016 (median), and .022 (high) is used in the figure.

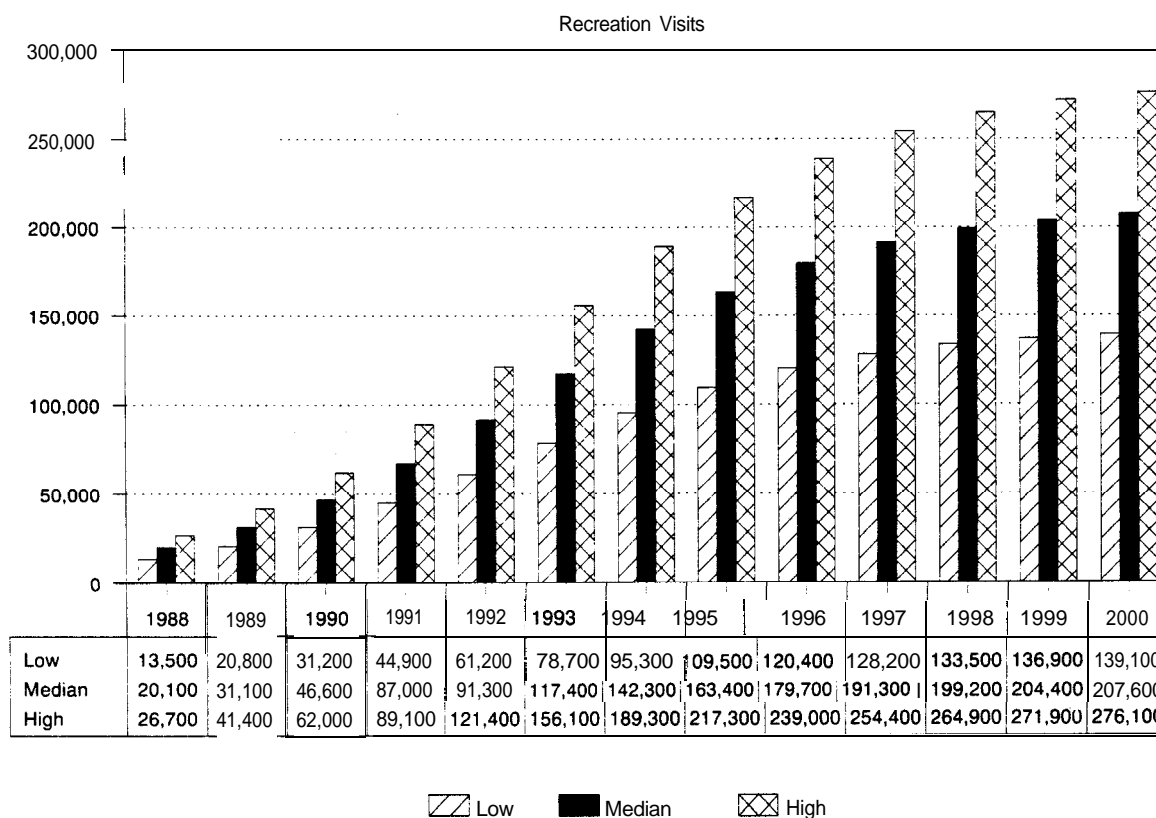
This visitation projection considers El Malpais National Monument and National Conservation Area to be one large recreation area. Although the monument and the conservation area are two distinct entities, it is currently not feasible to make a reliable, systematic prediction of visitation for each of the individual areas. However, it is likely that many recreationists will stop at both national monument and conservation area.

It should be remembered that the projections in figure 5 are based on comparisons to well-established and well-known parks. Thus, the projections inherently assume that El Malpais is also well-established and well-known. This assumption is corrected for in figure 6, which considers the possible growth patterns for the monument. In general, once a park is created, it

typically takes from five to 10 years to reach a level of use comparable to a well-established facility. El Malpais should achieve this visitation around the year 1995. During the period of initial growth (1988-1995), it is assumed that the monument will gain in popularity and that facilities (such as visitor centers, campgrounds, tour roads, and trails) will be developed. Figure 6 also presents low-, median-, and high-case scenarios.

Referring to figure 6, it is possible to determine that annual recreation visits to El Malpais may reach about 207,600 by the year 2000. By extrapolating from figures 4 and 6, it is possible to determine that the average visitation per day during the peak-use month in the year 2000 may be approximately 1,375. The peak-day use in 2000 may exceed 2,000 visitors.

**FIGURE 6: POSSIBLE RECREATION VISITATION GROWTH\***  
**EL MALPAIS NATIONAL MONUMENT/  
NATIONAL CONSERVATION AREA — 1988-2000**



\*Assumes a seven-year initial growth period, with the monument nearing the visitation of a well-established unit around the year 1995. The projections for 1995 correspond to those summarized in figure 5.

It is currently infeasible to forecast use patterns or volumes for specific areas within the monument/conservation area. The volume of use in any one area may vary over time. Use patterns may change significantly as visitor facilities and programs are developed. Use patterns will also vary as El Malpais becomes better known and develops a broader user constituency. Finally, use patterns are likely to change as the ratio of first-time visitors to repeat visitors evolves.

## EXISTING FACILITY ANALYSIS

### VISITOR USE OVERVIEW

Interstate 40, a major cross-country route, parallels the northern boundary of the monument/conservation area. This portion of I-40 actually bisects one of the northernmost lobes of the Grants flow, exposing travelers approaching from the east to a small sample of the El Malpais. There are few signs for the monument. A small interstate sign identifies the Grants exit as the location of the El Malpais information center. Two small El Malpais National Monument/National Conservation Area entrance signs are at the boundary on NM 117 (south entrance) and NM 53 (south entrance).

The temporary El Malpais information center in downtown Grants is currently the only place where visitors can plan their trip to El Malpais and ask questions about other regional attractions. Visitors can obtain an El Malpais brochure and other publications on the resources in the area. NPS and BLM personnel operate this small information center (an information desk and sales/publication area).

From the information center, visitors interested in spending a few hours in El Malpais are directed to the area's major features, including **Bandera** Crater and the Ice Cave and Sandstone Bluffs overlook in the national monument, and La Ventana natural arch in the national conservation area. Most tourists visit what for many years has been a regional tourist attraction – **Bandera** Crater and the Ice Cave, 25 miles southwest of Grants on NM 53. For an admission fee, visitors follow well-defined trails to the crater and Ice Cave. A stairway descends to a viewing platform near the floor of the Ice Cave. Little interpretation is provided at either the Ice Cave or crater. A small trading post adjacent to the trailhead/parking area gives visitors an opportunity to buy Indian jewelry, postcards, and other curios. Many visitors may also choose to travel NM 117 to Sandstone Bluffs overlook for views of the **McCarty's** lava flow. Visitors may also drive farther south on NM 117 to La Ventana – New Mexico's largest natural arch. No interpretation is currently provided at either the overlook or the arch.

Local residents frequently visit Bat Cave (near NM 53, approximately 20 miles southwest of Grants)

during the summer months to see the evening bat flight.

Prior to designation of El Malpais as a national monument/conservation area, the backcountry lava flows were used primarily for pot-hunting (now illegal), four-wheel driving, and hiking. Most of the backcountry still receives little use.

### EXISTING ROADS

New Mexico Highway 53 (NM 53), a paved two-lane road on the monument's northwest boundary, and NM 117, a similar road on the eastern boundary, will probably always remain the primary access roads to the monument and conservation area. I-40, a major cross-country travel route, links NM 53 and 117 in the area of Grants.

Direct access to the monument's main resources is on a small number of secondary roads, the most heavily used being a short graded road from NM 53 to the trading post near **Bandera** Crater. A primitive dirt road winds from the trading post to areas near Lava Crater. This road is on the south slope of Sandstone Ridge above the edge of the **Bandera** lava flow. Another important access road on the west side of the monument is County Route 42, a narrow dirt road that connects NM 53 to NM 117 on the west and south sides of the monument. Table 11 below shows the existing roads and their conditions.

### EXISTING TRAILS

The monument has few existing trails, and those receiving any significant volume of use are in the **Bandera** Crater area (see table 12). These trails total approximately 8.5 miles, are not uniformly signed, and most are surfaced with cinders. None of these trails meet Uniform Federal Accessibility Standards.

TABLE 11: EXISTING ROADS (IN MILES)\*

Name and Location	Dirt	Gravel	Paved	Condition
NM 53 to trading post		0.7		good
Route 42 to East Rendija cutoff	5.3			fair
Cutoff to East Rendija	3.5			poor**
Cerro Encierro	7.3			very poor*
Corral road	3.2			poor*
Bat Cave road	1.5			poor**
El Calderon road	2.9			poor*
Zuni-Acoma trailhead		0.1		good
Sandstone Bluffs road		1.7		good
North pasture ridge road	1.3			fair
North windmill road	.2			fair
North pasture road	5.5			poor**
Mechenbiers lava road	<u>3.5</u>	—		fair**
<b>Total Length</b>	34.2	2.5		

\*With the exception of a portion of Route 42, the table does not contain roads within the monument boundaries that are owned or maintained by county or state government or that are used entirely for private access to nonfederal land within the monument.

"These roads are nonconstructed and extremely rough, requiring high-clearance vehicles. In winter and during periods of heavy rainfall, they are muddy and may be impassable.

TABLE 12: EXISTING TRAILS\*

<u>Name and Location</u>	<u>Approximate Length (miles)</u>	<u>Standard*</u>	<u>Condition</u>
Trading post to Ice Cave	0.2	R	good
Trading post to Bandera Crater	0.8	R	good
Bandera Crater to Ice Cave (motor tour route)	0.5	R	fair
Zuni-Acoma/Acoma-Zuni	7.0	P	fair
Zuni-Acoma trail to overlook – west end (mileage included in above figure)	—	R	good
<b>Total Length</b>	8.5		

\*None of these trails are presently handicap-accessible.

\*\*D - Developed, R - Rustic, SP - Semi-primitive, P - Primitive

(These categories correspond to definitions of the trail standards in appendix D.)

The only other existing trail in the monument is the Zuni-Acoma/Acoma-Zuni trail; this marked route extends 7 miles between NM 53 and NM 117 across the El Malpais badlands. The trail has no treadway but is marked. The western end of the trail is graveled for less than 0.1 mile and leads to an overlook. The last half mile of the eastern end of the trail detours from the historic alignment to avoid Acoma land, and there is no trailhead or parking.

EXISTING STRUCTURES

Table 13 lists the structures that have potential for continued use in the monument and evaluates their condition. The approximate locations of these structures are shown on the development concept maps.

TABLE 13: EXISTING STRUCTURES

Area	Structure	Function	Condition
Bandera Crater	trading post	information/	fair
	(main structure)*	sales	
	tourist cabins (7)**	storage or empty	fair
	other cabins (3)***	seasonal residence	
		or storage	fair
	pit toilets-	toilets	poor
	parking area*	visitor parking	fair
	rails and fences*	separate visitors	
		from nonuse areas	fair

\*Under consideration for rehabilitation.  
\*\*Under consideration for stabilization.  
\*\*\*Under consideration for removal. (Other minor structures such as water tanks and liquid propane tanks are also under consideration for removal; see the Bandera Crater Area development concept map.)

## EXISTING UTILITIES

### Water

The only developed water supply in the monument is for the privately owned trading post at **Bandera Crater**. The source is a surface spring outside the northern monument boundary. The pump and lines leading approximately 2 miles to the trading post often freeze in the winter. The quality and available volume of water in this system has not yet been evaluated. (See the "Water Resources" section for more information.)

### Power/Telephone

Single-phase power (14.4/24.9 volts) is available on an aerial line just north of NM 53 in the monument. The closest three-phase power is 12 miles west of the monument in the **Ramah** area. There is a rural telephone system with aerial lines on the same poles as the powerlines that serve the **Bandera Crater** area. Aerial power/telephone lines also cross the El Calderon area and parallel NM 117 near Sandstone Bluffs.

### Sewage Treatment

Other than pit toilets and septic tanks at the trading post near **Bandera Crater**, there are no sanitary facilities in the monument.

### Radio System

There is no radio communication system for the monument staff; however, a future system is under study and will be installed as soon as possible. Repeater station sites inside and outside of the monument are being considered.

## ADMINISTRATIVE FACILITIES

Since the establishment of the monument, office and storage space for NPS staff has been in rented facilities in Grants, New Mexico. The superintendent initially had office space in the Grants Chamber of Commerce/Mining Museum building. Other monument staff were stationed at a temporary information center at 620 East Santa Fe Avenue. This building was shared with BLM staff,

and space was crowded. In March 1989 NPS staff relocated to the former U.S. Forest Service building at 201 East Roosevelt Avenue. This building is being leased from the U.S. General Services Administration.

## IMPACTS OF PREFERRED ALTERNATIVE (PROPOSED GENERAL MANAGEMENT PLAN)

### INTRODUCTION

This section evaluates the impacts of implementing the preferred alternative, including impacts on the natural and cultural environments, impacts on the visitors, and impacts on the socioeconomic environment.

### IMPACTS ON THE NATURAL ENVIRONMENT

Implementation of the preferred alternative would result in two kinds of impacts on the natural resource and wildlife management. First, the information in the studies and management plans (described in the "Plan for Natural Resources Management" section) would improve the ability of the Park Service to manage and protect the monument's natural resources including backcountry/wilderness, lava tubes and ice caves, air quality, wildlife, threatened and endangered species, and vegetation. Additional inventories and studies would be the basis for prioritizing research and protection needs, and the backcountry/wilderness management plan(s) would establish standards for use in these areas. In short, the information would promote better protection for the monument's natural resources.

Second, impacts would result from visitor use and facility construction; these impacts are described below.

The proposed boundary adjustment would not impact natural resources. The area proposed for exclusion contains no known significant natural resources.

#### General Impacts from Development and Visitor Use on the Natural Environment

Sensitively and properly designed facilities and careful design and alignment of roads and trails would result in minimal resource damage and harmonize with the surrounding environment. Monitoring visitor use associated with development would also aid in more effective management and protection.

Overall, monumentwide impacts from facility development would be minor, with no significant long-term effects on natural resources except minor disturbance of bedrock, which would be an irretrievable long-term loss. Construction and use of facilities associated with the preferred alternative would impact approximately 63 acres or .05 percent of the monument.

#### Impacts on Geological Resources

**Bedrock.** Bedrock within some proposed construction sites would be removed to bury utilities and construct buildings, trails, roads, and parking areas. This would require ripping or blasting. The fracturing/removal of bedrock would be an irretrievable long-term loss of geologic resources.

Exposed sedimentary bedrock in areas of intense visitor use would be subject to defacement (carving of initials) and, in areas of heavy foot traffic, accelerated erosion. The areas with the most potential for bedrock degradation include Sandstone Bluffs and Sandstone Ridge. Sedimentary rock permanently exposed by construction activities would increase the natural erosion rate of this bedrock. Heavy foot traffic in popular visitor use areas such as Sandstone Bluffs would result in minor bedrock erosion; however, trails and viewing platforms would be properly designed to discourage off-trail use.

Site-specific impacts on bedrock follow.

**Multiagency Center** – Construction of a 7,000-square-foot facility with parking and a .2-mile-long approach road would require removal of an unknown volume of basaltic bedrock, perhaps by means of ripping or explosives. Burying utilities between the I-40 exchange area and the facility in two separate trenches for water and sewer mains would entail removal of about 1,900 cubic yards of bedrock, which would be permanently disturbed.

**Bandera Crater/Lava Crater Area** – Construction of a .7-mile two-way road

between NM 53 and the proposed 7,500-square-foot visitor center; a 2.0-mile one-way road between the visitor center and the trading post area; a .3-mile two-way spur road to the Dripping Lava Cave trailhead; a .4-mile two-way spur road between NM 53 and the proposed residential/maintenance area; a .8-mile exit road from the trading post to NM 53; and proposed parking areas at the visitor center, near the trading post, and at the Dripping Lava Cave trailhead entails irreversible disturbance of bedrock. The bedrock that would be disturbed consists of volcanic cinder to unknown depth in an area of 5.7 acres and sandstone/limestone in an area of 3.5 acres – a total surface disturbance of 9.2 acres of bedrock.

The one-way tour road, excavated partly in bedrock, would be on slopes requiring side-hill excavation of sandstone/limestone to a maximum depth of 3 feet (but probably averaging 2 feet), thereby entailing removal of about 2,800 cubic yards of bedrock, which would probably be used as fill elsewhere during construction in order to balance material. The result would be long, 1- to 3-foot-high cuts exposing light-colored bedrock over a distance of 1.6 miles along the lower east, south, and west slopes of Sandstone Ridge. The parking area proposed east of the trading post is likely to be on more than one level and also would be bordered along its upslope side by cuts of similar appearance.

Approximately 3.8 acres – for the proposed visitor center and residential/maintenance areas -would be disturbed by construction, landscaping, and trenches for power, water and sewer lines, and treatment fields. The cinder and other bedrock underlying these areas would be removed temporarily to depths up to 6 feet, and most of it would be used as backfill at the construction sites.

Because new trails proposed in the area require insignificant amounts of bedrock to be removed, little impact on geologic resources is expected. The principal exceptions include the following:

Construction of catwalk-like steps into Dripping Lava Cave, replacing the

stairway into the Ice Cave, and the addition of handicap viewing area would require removal of small quantities of basalt bedrock to level platform areas and drill holes for structural supports.

Construction of a wheelchair-accessible trail of even grade to the Ice Cave would require total removal of about 50 cubic yards of basalt bedrock. Using portions of existing routes would be a significant mitigating factor for reducing disturbance to geologic features.

Marking primitive trails would require frequent cairns; loose boulders in the local surface areas would be used for this purpose.

Fragile “lavacicles,” pencil-slender masses of lava that hang from the walls and ceilings of Dripping Lava Cave (and other caves), could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**East Rendija Area** – The proposed 6-mile 20-foot-wide gravel-surfaced access road to the East Rendija trailhead would disturb about 13 acres and would be built across three types of terrain. The first 2 miles north, west, and southwest of Cerro **Bandera** would be on lava flows with irregular surfaces and shallow soil, probably requiring explosives to make short cuts in outcrops of bedrock. In contrast, the second 2-mile segment, which would likely follow sections of Route 42, would be on relatively flat areas of old lava flows overlain by stony soil; here there would be low potential for disturbing bedrock because adequate drainage would probably be provided by importing material for an elevated road course. Construction of the third and southernmost 2-mile segment on the lower northern slopes of Cerro Rendija would likely require upper- and lower-side balance of stony soil material; removal of bedrock beneath the soil would be possible locally.

Construction of an approximately 1 -mile trail up the southwest side of Cerro **Bandera** would cut slopes composed of cinder and volcanic agglutinate; however, the treadway would be

designed to minimize downslope loss of cinder bedrock and aligned to reduce the potential of visitors shortcutting the switchbacks.

The proposed campground, vault toilets, parking areas at the lava wall and East Rendija, and trails leading to lava caves would be located in areas where little solid bedrock would be disturbed.

Constructed steps into the entrances of Four-Window and Big Skylight caves would be made of boulders from the nearby surface areas; however, supports for hand rails needed in the caves might require drilling holes into boulders or bedrock.

**Braided Cave Area** – Fragile lavacicles hanging from the walls and ceilings of the cave could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**El Calderon Area** – Construction of a .9-mile 18-foot-wide gravel-surfaced road from NM 53 to a new trailhead serving both Double Sinks and Bat Cave would require the same type of road building as the midsection of the East Rendija road (described above). Similarly, eventual improvement of the narrower 1.6-mile El Calderon road would also be accomplished with an elevated prism, which would require importation of road material (and little disturbance of bedrock). Construction of trails proposed in the area would disturb soil, not bedrock.

**Zuni-Acoma/Acoma-Zuni Trail** – Improvement of the first 0.1 -mile of existing trail on the west end for wheelchair access would be done by importing fill rather than cutting into bedrock. There would be no impacts to geological resources on the east end of the trail.

**Las Ventanas** – Construction of the new .1-mile 20-foot-wide paved spur road to the Las Ventanas trailhead off of the existing Sandstone Bluffs road would be largely in soil and use fill in low areas rather than cutting into sandstone bedrock. The new trail leading

northward to Las Ventanas from the parking area along ridges to the area of the kivas would be relatively low standard, mostly on soil with a few short segments directly on naturally exposed bedrock. No impacts on bedrock are expected. There would be no differences in impacts on geological resources between options 1 and 2.

**Sandstone Bluffs** – Paving the existing gravel road, redesigning the parking area, and installing vault toilets would require no disturbance of bedrock. In one area where a sharp curve in the road is to be realigned, disturbance of the underlying sandstone would be avoided. A wheelchair-accessible trail between the parking area and the sandstone ledges at the top of the cliffs would require installation of a stone or concrete surface that is visually compatible with the surrounding environment. The only possible disturbance of rock would be drilling holes in the sandstone to support interpretive signs.

**The Narrows** – Rock surfaces would not be disturbed to build the six-space parking area adjacent to NM 117. A wheelchair-accessible ramp and a short boardwalk to the viewpoint might require drilling holes in the basalt. The primitive trail onto the **McCartys** flow beyond the viewpoint would be on the flow surface, and the only impact on geologic resources would be local gathering of boulders to make cairns along the route.

**McCartys Crater Viewpoint** – Should option 1 be selected, construction of a .3-mile 20-foot-wide paved spur road between NM 117 and the new parking area, and a short trail to a viewpoint of the crater would be undertaken. The road and parking area would be on alluvial soils, and the trail leading up the ridge to the observation point would be mainly on shallow rocky soil rather than disturbing the underlying sandstone. Impacts on geologic resources would be minimal.

If option 2 is selected, there would be no impact on geologic resources.

**Roadside Kiosk Along NM 117** – There would be no impact on geologic resources.

**Ice Caves and Lava Tubes.** Continued visitor use of lava tubes would increase the potential for damage within caves, including damage to geologic resources. Proposed research, inventories, monitoring, and a cave management plan would provide basic protection for fragile geologic and hydrologic features of these resources.

Backcountry use in areas containing lava tubes could result in isolated acts of vandalism that would destroy delicate volcanic features. The most fragile geologic resources are lavacicles – pencil-slender masses of lava that hang from the walls and ceilings of some lava tubes. Colorful ceiling and wall “mosaics” and “silver formations” in remote lava tube locations could be scarred by initials or other graffiti. A future backcountry management plan with restrictions on public use of caves as well as public education in visitor centers and through other media would help reduce damage to these delicate geologic features while ensuring that visitors could see examples of outstanding cave formations.

### **Impacts on Soils, Vegetation, and Wildlife**

Use of heavy construction equipment, paving, settling of structures, trenching, grading, and repeated foot and vehicular traffic would result in soil compaction and disturbances to vegetation, soils, and wildlife in and adjacent to proposed construction sites and areas of intense visitor use, particularly on sloping and denuded sites. Erosion would result in a loss of topsoil and alteration of soil strata. Soil compaction would reduce infiltration of water and air into the soil and increase the potential for soil erosion. Over time, reduced infiltration of water and air would alter soil chemistry, which in turn would alter vegetative composition. Water falling on these surfaces would be deflected to adjacent low-lying areas, altering natural flow patterns, soil chemistry, and adjacent plant species and densities. Compacted soils also restrict wildlife burrowing, which would reduce the value of these areas as wildlife habitat.

Use of proper soil erosion reduction techniques; properly designed facilities, roads, and trails, and effective interpretive media would help reduce trampling of vegetation and soil erosion and compaction problems. Use of stockpiled topsoil during reclamation efforts would also help reduce potential soil erosion problems. Interpretive

materials and programs, restrictive signing, routine ranger patrols, and night closures of some high-use areas (such as Sandstone Bluffs and the Bandera visitor center/trading post complex area) would also help reduce impacts on resources.

Monumentwide, development and use of facilities would result in the removal of approximately 63 acres of vegetation/soil/wildlife habitat. Overall disturbances would be minimal, affecting approximately .05 percent of monument vegetation/soils/habitat (see table 14). Disturbed habitat would affect primarily ground-and tree-dwelling invertebrates, rodents, and birds. Some animals, including mammals, invertebrates, and birds, would be temporarily or permanently displaced because of construction noise and increased visitor use. Revegetation of about 30 acres adjacent to new roads and facilities (including restoration of the Corral road, portions of Route 42, the Bat Cave road, and backcountry vehicular ways) would offset the 63 acres affected by new construction and would allow for recovery/restoration of soil and reduce erosion problems, as would reclamation of the cinder mine and borrow pits. All revegetation would be done with native plant species, which would restore natural resource values of the sites.

Following construction, increased visitation and use of the multiagency center, **Bandera Crater area**, **Sandstone Bluffs**, **East Rendija**, **Zuni-Acoma/Acoma-Zuni Trail**, **McCartys Crater viewpoint**, the **Narrows**, and **El Calderon** would result in increased adjacent disturbances to soil and vegetation from foot traffic. Some low-growing plants susceptible to disturbance by trampling – grasses, forbs, lichen, ferns, and cacti – would be affected. Disturbed areas would be susceptible to invasion of exotic plant species such as cheatgrass, tumbleweed, and Russian thistle. Native increasers (species that spread when areas are disturbed) such as rabbitbrush, snakebrush, and cholla would also spread, reducing the potential for reestablishment of a natural vegetative density.

Some animals could become habituated to human presence following construction. Certain species, such as black bear, are often attracted to human food sources; problem animals might have to be removed, which could result in their death. Animal-proof trash containers at developed areas would reduce the potential for habituation of wildlife

**TABLE 14: SUMMARY OF VEGETATION/SOILS/WILDLIFE HABITAT IMPACTED (ACRES)**

<u>Proposed Development Site</u>	<u>Preferred Alt.</u>	<u>Minimum Rea. Alt.</u>
Multiagency center	10.00	10.00
Bandera Crater/Lava Crater	25.50	6.00
East Rendija	19.00	—
Braided Cave	.30	—
El Calderon	3.50	—
Zuni-Acoma/Acoma-Zuni Trail	.50	.50
Las Ventanas	1.00	—
Sandstone Bluffs	.30	.03
The Narrows	.80	—
McCartys Crater viewpoint (option 1)	1.30	—
Roadside Kiosk along NM 117	.50	.50
Total	62.70	17.03
Percent of Monument Affected	.05	.01

to human-food sources. Additional vehicular traffic would result in increased wildlife road kills.

Hedgehog cactus, abundant on the lava, produces clusters when mature and is very popular with collectors. Cactus collection could become a problem as visitation increases.

A determination would be made about the appropriateness of reintroducing bighorn sheep to the monument.

Overall, vegetation/soils/wildlife impacts would be minimal and localized; there would be no significant long-term effect on monumentwide populations or soils. Following are site-specific impacts on vegetation, soils, and wildlife.

**Multiagency Center.** Development of access and the center itself would result in disturbance of approximately 10 acres of the grass/shrub vegetation class<sup>44</sup> and associated soils. Impacts to wildlife would be minimal because the site is not notable wildlife habitat. Previous and existing

disturbances such as the I-40 corridor, Grants development, grazing, and other man-related activities have decreased the value of this area as wildlife habitat.

**Bandera Crater/Lava Crater Area.** Construction of the trail system would result in impacts to approximately 3.5 acres of lava, shrub/conifer, mixed conifer, and ponderosa parkland vegetation, associated wildlife habitat, and soils. Development of the visitor center, the area around the trading post complex, parking areas, and the **NPS** maintenance and residential area would disturb about 7.5 acres of mixed conifer vegetation and associated soil and wildlife habitat. Construction of the visitor center would impact approximately 2.0 acres of pinyon-juniper woodland and ponderosa parkland vegetation and associated soil/wildlife habitat. Construction of the one-way tour road would require substantial soil, habitat, and vegetation disturbance through this narrow sandstone/lava ecotone (5 acres). The other roads in the area (maintenance, entrance, exit, and Dripping Lava Cave road) would disturb an

44. The vegetation classes used in the following description are the same as those that are listed in the "Affected Environment" section under vegetation.

additional 5.5 acres. Construction of buried utility lines would disturb about 2 acres of vegetation, soil, and wildlife habitat. To the extent surface drainage and groundwater patterns are disturbed, vegetative species composition along the new roads could change. Aspen, oak, and various forb species could be replaced by species requiring less water such as pine and juniper. Soils along the one-way tour route and on Sandstone Ridge are moderately to highly erodible, and use of erosion prevention techniques would reduce adverse impacts.

Development of leachfields at the NPS housing area and Bandera visitor center would result in local increases in soil moisture and nutrients. This would alter soil chemistry and vegetation composition at these sites. A dense growth of vegetation at the site would result.

Bears frequent this area of the monument, and human/bear encounters could become a problem. Other wildlife, including burrowing species, would be impacted by the displacement and possible demise of some individuals during facility construction.

**East Rendija Area.** Improvements and realignments to Route 42 and the parking areas would result in impacts to approximately 17 acres of shrub/conifer and mixed conifer vegetation/soils/habitat. Construction of trails would impact approximately 2.0 acres. Disturbances would be similar to those described above.

increased foot traffic into Big Skylight and Four-Window caves and Seven Bridges and Caterpillar collapses would impact fragile cave vegetation, including moss, lichens, and ferns. Surface vegetation such as cactus would be subject to trampling and illegal collection.

**Braided Cave Area.** A marked route to Braided Cave would increase visitation and result in trampling of lichens, cacti, and shrub/conifer vegetation. Illegal cactus collection could also occur. Approximately .3 acres of vegetation/habitat would be removed to establish a small parking area.

**El Calderon Area.** Widening the El Calderon road would disturb approximately 2.0 acres of mixed conifer vegetation/habitat and associated soils. Approximately 1.2 acres of shrub/conifer vegetation/soil/habitat would be disturbed by new road development between Junction Cave and Bat

Cave, including parking areas. Trails would disturb about .3 acre of shrub/conifer vegetation soil/habitat. Lichens and other cave entrance vegetation could be trampled by visitors. About 4 acres of vegetation would be restored after closing the Corral road and the abandoned segment of the Bat Cave road.

If visitors continue to enter the Bat Cave, the Mexican free-tailed bat colony would probably continue to decline, resulting in the eventual loss of this colony. With the proposed plan, however, visitors would not be entering the cave and would be watching the flights from a safe distance. The signs explaining the dangers to the bats and visitors would reduce the number of visitors going into the cave, as would a more controlled viewing experience and the presence of monument personnel. The reasons for the bat population decline in Bat Cave is unknown; however, it is assumed that closing the cave to visitation would help stem the decline. If this does not prove to be the case, additional protection measures (fencing and increased patrols) would be initiated.

**Zuni-Acoma/Acoma Zuni Trail.** The grass/shrub vegetation at the west access and the mixed conifer and lava vegetation along the trail would not be impacted by the minor upgrade of trailhead facilities. The impacts on 0.5 acre of land on the east side from construction of a the parking area and trailhead would also be minor.

**Las Ventanas.** Selection of option 1 would result in disturbance to approximately 0.5 acre of soil/vegetation/habitat for road and parking construction and 0.5 acre for trail development (both impacting the sparse/bare vegetation class).

Impacts from selection of option 2 would be very similar to option 1. The difference would be a slight increase in disturbance to soils, vegetation, and wildlife from removal of backfill and stabilization of the tower kiva.

**Sandstone Bluffs Overlook.** Continued visitor use and associated disturbances would continue to reduce the potential for raptors to nest and other wildlife to inhabit the bluffs. Site improvements would result in removal of approximately .3 acre of sparse/bare vegetation mixed with pinyon-juniper and associated soil and wildlife habitat.

**The Narrows.** About 0.5 acre of grass/shrub vegetation, soils, and wildlife habitat would be removed for the proposed parking area. Construction of the trail would impact approximately .3 acre of grass/shrub and lava vegetation and associated soil/habitat. Impacts to cacti and lichen might be a problem because of trampling by off-trail hikers and illegal cactus collection.

**McCartys Crater Viewpoint.** Selection of option 1 would remove approximately 1.3 acres of shrub/conifer vegetation and related soil/habitat.

Selection of option 2 would result in no impacts on natural resources because no development would occur under this option.

**Roadside Kiosk Along NM 117.** Approximately 0.5 acre of soils and grass/shrub vegetation, soils, and wildlife habitat would be impacted by construction and use of the kiosk and parking.

### **Impacts on Threatened and Endangered Species**

A preconstruction survey and evaluation of the development sites and a monumentwide survey for threatened and endangered species would inform managers about the status of these special species. If any of these species are identified, protective measures would be developed in consultation with the USFWS and state agencies. No known adverse effects on federal or state endangered or threatened species would occur from implementation of the preferred alternative.

### **Impacts on Water Resources**

As facilities are developed and visitor use increases, so also will the demand for domestic water increase. Use of a well in the **Bandera Crater/Lava Crater** area would result in loss of a relatively small quantity of groundwater; however, the overall impact on the area's groundwater supply would be minimal with no long-term consequences. Most water from rain and snow enters porous volcanic soils directly; there is a general paucity of flowing or standing groundwater in all of the monument. The development and use of groundwater from deeper aquifers would result in only minor impacts on ground water quality and quantity in the region. Low-consumptive water use

facilities would reduce the potential impact on the area's groundwater resources.

### **Impacts on Floodplains and Wetlands**

No facilities or visitor use areas are proposed in floodplain or wetland areas; therefore there would be no impacts.

### **Impacts on Air Quality**

Overall effects on the monument's air quality would be short-term and minor, including localized increases in dust and exhaust fumes from construction activities. Vehicular use associated with increased visitation and NPS operations would result in minor seasonal increases in vehicular pollutants, primarily dust. Increased dust along dirt roads would result in the decreased vigor of some roadside plant species.

The overall air quality values of the monument would not be affected. No state or federal air quality standards would be violated.

### **Impacts on Visual Quality**

New facilities would result in increased levels of visual intrusion, the intensity depending on density and height of adjacent vegetation, terrain, and facility design, size, and location. Buildings, roads, and parking areas would be the most intrusive, while trails would be much less intrusive. Careful facility planning and design would alleviate impacts on visual quality at and around development sites.

The closure of ways and the restoration of the Corral road, portions of the Bat Cave road and Route 42, and the backcountry vehicular ways would improve visual quality of these areas. Revegetation with native species would also aid in restoring the visual integrity of the sites.

The boundary proposal for the multiagency center site protects an adequate southern viewshed. In the **Bandera** area, the trading post and Ice Cave stairway would still be noticeable from the top of Cerro **Bandera**; however, improvements would be designed to blend with the surrounding environment. The new visitor center, housing and maintenance facilities, access roads, parking areas,

and trails may intrude on the views from Sandstone Ridge and Lava Crater. Elimination of the sight of vehicles and dust on the section of Route 42 that would be closed would improve the visual quality for visitors in the Bandera area.

In the East Rendija area, the new parking and trailhead areas would be a local visual intrusion. In the El Calderon area, because roads already exist in the area, proposed development (including the new road and other road improvements) would be local intrusions to the visual quality in the area. At Las Ventanas the construction of a parking area, spur road, trailhead, and trail would result in local visual intrusion in the area. Because of little expansion of the existing development at Sandstone Bluffs overlook, there would be minimal additional disturbance of visual quality, except the viewing area structure, which could be a minor visual intrusion if it is built. The new facilities at the Narrows would be a minor visual intrusion on this area, which now contains no development; however, the new parking area and trail could be a visual intrusion from the proposed BLM overlook on the cliff above the site. The new access road and parking at McCartys Crater viewpoint would be a local visual intrusion to visitors.

Reclamation efforts would restore the resource values and visual integrity of the cinder mine and borrow pit areas.

### **Impacts on Audio Quality (Natural Quietness)**

Construction of new facilities would result in minor, short-term, construction-related noise. Increased visitation would result in minor degradation of audio quality primarily at visitor facilities.

## **IMPACTS ON THE CULTURAL ENVIRONMENT**

Implementing the preferred alternative for cultural resource management would result in the collection of important information about the monument's cultural resources and the development of plans and guides that are necessary for improved decisions about protecting and managing those resources. These resources and management concerns include the cultural landscape; national register properties; looting, vandalism, and degradation of the resources; existing conditions of the resources; effective interpretation; and

management of the cultural resources collection. Consultation with American Indians on various subjects would ensure attention to their concerns and ensure improved communication and trust between the Park Service and the American Indians.

Under the preferred alternative, additional law enforcement personnel and increased patrols would deter illegal looting and vandalism. Sites and areas most vulnerable to looting and vandalism would be identified, and increased protection and monitoring would be achieved through agreements with private owners, state and other federal agencies, and Indian tribes.

Coordinating law enforcement with other agencies and providing training for monument employees and volunteers would help law enforcement efforts. Changing a few placenames so as to avoid implications of the presence of important cultural resources would also help ensure protection of some sites.

Because 83 percent of the monument has been determined to be suitable for wilderness (see "Wilderness Suitability Study"), these lands will now be managed as wilderness. This will prohibit certain road access in remote portions of the lava flows and limit the number of visitors who would impact remote archeological and ethnographical resources.

Close coordination between the Park Service and the Bureau of Land Management in program development and operations would ensure effective resource management.

The proposed boundary adjustment, preceded by BLM or NPS cultural resource inventories, would not limit or impede access for American Indians. Appropriate mitigation measures would be taken if cultural resources were discovered.

### **General Impacts of Development and Visitor Use on the Cultural Environment**

Proposed construction could directly affect unknown subsurface archeological resources by disturbing and compacting soils and damaging artifacts and site context. Improved access and concentrations of visitors would lead to secondary impacts, those from informal trails and illegal collection. However, construction would be planned

to avoid areas of known cultural resources, and surveys, investigations, inventories, and evaluation of integrity and significance would be conducted to prescribe mitigations prior to final comprehensive design. These mitigations would also be performed in areas surrounding development areas to avoid secondary impacts. Careful planning and design would also help ensure that facilities would be in character with historic properties and their settings and the cultural landscape.

In special cases, limiting or blocking visitor access or site visibility would reduce site vulnerability. Well-defined self-guiding trails would discourage visitors from leaving established routes and collecting or inadvertently disturbing resources. Public involvement programs would help change attitudes about responsibility for protection of archeological resources.

Adaptive reuse and proper stabilization and maintenance of historic structures, as well as preparation of historic structures reports and preservation guides and conducting archeological research would help preserve these resources.

In all cases, design, closures, relationships between use and trespass, and traditional Indian uses would be discussed with concerned American Indians during planning and prior to design of facilities; this would ensure mutually satisfactory decisions regarding resource protection, development, and use. Preparation of interpretive information in consultation with American Indians would help ensure accurate and sensitive public presentations and also ensure that American Indian cultures would be interpreted as part of the whole El Malpais cultural landscape.

### **Site-Specific Impacts on the Cultural Environment**

**Multiagency Center.** Construction of the multiagency center and associated roads, utilities, parking, and landscaping might impact unknown archeological sites on the 10 acres required for these facilities. Secondary impacts might occur at sites outside the construction zone because of increased visitation and use. Some of this area has been previously impacted by dumping and use of informal roads, and no archeological sites have been reported here. American Indian groups do not appear to have any special concerns for traditional

resources and sites in this area. All cultural resources investigations, evaluations and mitigations (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

**Bandera Crater/Lava Crater Area.** Developments covering approximately 25 acres, (including construction of a new visitor center, employee housing, maintenance facilities, roads, trails, parking, and utilities at the Bandera Crater/Lava Crater area) and increased visitor use might disturb known archeological resources and would likely impact unknown archeological resources during construction. Visitors exploring lava tubes, including Dripping Lava Cave, might encounter archeological resources. However, some roads and trails would follow previously established corridors. All cultural resources investigations, evaluations, and mitigations, including consultation with the State Historic Preservation Office (as described previously) would precede comprehensive design, and construction would avoid sites. This would include secondary impact areas. Because the Bandera area would be one of the top two priorities for intensive survey and documentation, the potential for disturbing sites would be reduced.

The abandoned sawmill site, dumps, and ruins of cabins in the vicinity of the proposed visitor center would be removed; however, archeological investigations, documentation, and mapping would precede removal.

Old trails on the lava near Bandera Crater could continue to impact known and unknown archeological sites. These sites would be surveyed, mapped, and their significance evaluated.

Adaptive use of the structures at the historic trading post complex would comply with section 110 of the National Historic Preservation Act, provide a rewarding interpretive opportunity for visitors and help protect the structures from fire, theft, and vandalism. Routine maintenance would ensure early detection and repair of structural deterioration, helping to preserve the historic fabric. Elimination of a short section of the existing roadway, changes in original vehicular patterns, and addition of new facilities could visually impact the historic trading post complex and remove landscape elements that were part of the historic scene.

Existing parking will be left in place along the east side of the complex, and careful site design and screening would ensure that modern additions do not visually intrude upon the historic scene. Prior to development, the existing roadways and any historic traces of earlier routes will be documented to NPS Historic American Building Survey standards.

Modification of trails and the viewing area at the Ice Cave to provide for wheelchair accessibility might change the appearance of both the trails and the viewing area. However, modifications would be kept to the minimum necessary for safety and accessibility.

Heavy visitation of the Ice Cave and Bandera Crater could interrupt American Indian religious activities. However, most religious use here will occur in winter when there are few visitors. Closures would be worked out between the American Indian groups and the superintendent, as necessary.

**East Rendija Area.** Development, including the improvements to Route 42, would disturb approximately 19 acres; secondary use might be expected to affect a larger area. Unrecorded archeological sites in the East Rendija area might be impacted by roads and trails. Wherever possible, development of roads, trails, and campsites would avoid sites and, as previously described surveys, investigations, mitigation, and compliance would precede development. Plans for trail design and access would be discussed with concerned American Indians. The secondary impacts of visitor use as previously described would be mitigated by archeological surveys, documentation, evaluation, and avoidance strategies. Monitoring programs and previously described mitigation strategies would help ensure site protection.

**Braided Cave Area.** Areas set aside for the unimproved dirt parking area, trails (consisting of about .3 acre total), and the cave itself would be investigated archeologically as described earlier. Secondary impact areas would also be investigated. Preliminary archeological investigations would help mitigate impacts on known and unknown sites.

**El Calderon Area.** New road construction and improvements (totaling about 2.5 miles), parking

areas, and trail construction might impact sites. However, sites near Bat Cave, Double Sinks, Junction Cave, and other local lava flow features as well as the trails and roads proposed for construction or improvement would receive comprehensive investigation, documentation, and compliance prior to development and increased visitor use.

Areas of secondary impact would include easily accessed lava features, El Calderon volcano, and the corridors and destinations along existing roads and informal foot trails. These would also be fully investigated, and appropriate mitigating measures would be taken.

It is probable that many archeological sites exist in this area, but their status is generally unknown. Surveys and monitoring would help avoid and protect sites wherever possible.

**Zuni-Acoma/Acoma-Zuni Trail.** Visitor use may be impacting archeological resources along the trail corridor, including some resources that are important to contemporary American Indians; however, surveys, inventories, and site evaluations would help mitigate some of these impacts. Additional markers would guide visitors around sensitive natural and cultural resources. Consultation with American Indians would also help determine which, if any, short segments of the trail would be realigned to protect resources and prevent trespass. The Park Service would continue to use the permitting process to direct visitors to areas of particular interest while minimizing impacts on fragile resources.

**Las Ventanas/Sandstone Bluffs.** Implementation of the preferred alternative might disturb known and unknown archeological sites along the length of the bluffs, a total area of approximately 1.25 acres. The proposed spur road, parking area, and trail to Las Ventanas particularly have the potential to impact archeological sites. Because the entire area from Sandstone Bluffs overlook north to the natural arch and the Las Ventanas site would be one of the top two priorities in the monument for intensive survey and documentation, the potential for disturbing sites would be reduced.

Because Las Ventanas is special to American Indians, and because sensitive sites need to be avoided, consultation with concerned groups, especially the **Acoma**, would be conducted prior to

construction. Also, because Las Ventanas is on the national register, the State Historic Preservation Office would be consulted to help develop mitigation procedures.

Construction of roads, parking, trails, waysides, etc. would be preceded by archeological investigations as previously described, including reevaluation of prior archeological work. Closure of the Las Ventanas/Sandstone Bluffs road at night would provide privacy for American Indian users and help protect archeological sites.

Careful trail and exhibit design (in part, warning visitors about the sensitive resources) would provide effective interpretive information while helping to protect sites from secondary impacts of visitor use. Waysides would be visually compatible with the character of the site to avoid intrusion on the historic scene.

Removal of fill in the tower kiva, under option 2, would allow visitors to see details of its original construction. This option would, however, increase the cost of maintenance and protection significantly and could contribute to loss of scientific data. Unstable masonry and cultural deposits would be exposed to erosion, creating a preservation problem. The interior of the tower kiva would hold rain and snow, causing the masonry and interior plaster to deteriorate. Differential pressure from unequal soil levels would cause kiva walls to shift inward. Long-term visitor use and exposure to the elements would make a high level of cyclic maintenance and site protection necessary. Artifacts would need to be analyzed and curated.

Archeological, architectural, and religious values that contribute to the integrity and significance of the site would be of primary concern during removal and stabilization of the fill. Following removal of fill, measures would be taken to protect exposed artifacts from erosion and vandalism. Preparation of a historic structures report, including plans for preserving the remaining kiva wall plaster before the project begins, would help mitigate impacts; backfill might be left in some areas of the kiva to protect and preserve this plaster, or alternative treatments could be developed. Drainage controls would be installed to prevent ponding inside the kiva and deterioration caused by the differential soil levels. Cyclic maintenance would be necessary.

Because Las Ventanas is listed on the National Register of Historic Places, proposals for the removal of the backfill and for wall stabilization would also be included in discussions with the New Mexico State Historic Preservation Office. Concerned American Indians would be consulted, and development of interpretive media in consultation with the Acoma would help ensure appropriate exhibits.

Investigations and evaluation of the old stone buildings in the general vicinity of Sandstone Bluffs would ensure proper treatment.

**The Narrows.** Careful archeological investigations and surveys, as described earlier, and consultation with the Pueblo of Acoma would ensure appropriate use of the area and avoid trespass or privacy problems.

**McCarty's Crater Viewpoint.** Under option 1, the trails, access road, and viewpoint would disturb about 1.3 acres. Precautions as previously described would be taken prior to construction (there is a historic site in the vicinity). Option 2, no development, would not affect the area's cultural resources.

**Roadside Kiosk along NM 117.** There would be no known impacts to cultural resources from this facility; however the area would be surveyed for potential cultural resources prior to design.

### **Impacts on Museum Collection**

The monument's museum collection would be properly protected and preserved. Necessary plans to guide the acquisition, management, and storage of the collection would be proposed. The new collections storage space in Grants would have the security and environmental controls to meet applicable NPS curatorial standards for those items stored there; items with specialized curatorial requirements would be transported to the NPS Western Archeological and Conservation Center for proper curation.

The proposed actions would protect all collections from fire, theft, and atmospheric degradation and ensure legal compliance. The longevity of museum materials would be increased, and better accountability, accessibility, and orderly retrieval of materials would be ensured.

Possible acquisition of objects and furnishings would ensure that memorabilia actually associated with early-day tourism at Bandera Crater would be available for interpretation to visitors. Use of authentic period furnishings for the cabins at Bandera would help interpretation of a realistic and nostalgic view of early 20th century tourism and recreation in this area.

## IMPACTS ON AMERICAN INDIANS

Increased visitation might make it more difficult for American Indians to conduct traditional activities in privacy and might intensify impacts on cultural sites that have significance to tribes. Visitors might accidentally trespass on Indian lands. Mitigation would include site monitoring, closure of specific areas, employee training and sensitivity programs, public education and information, and other programs as described in the "Plan for Cultural Resources Management." El Malpais managers have already begun a system to contact and consult with concerned groups.

There may be concerns by Indian groups about continuing access to religious sites or other important resources. These problems would be worked out by continued consultation between the monument staff and the concerned tribe. The monument might want to use the Native American Consultation Committee (discussed in the "Plan for Cultural Resources Management" section) as a forum where such concerns can be aired.

Proposals to clear and thin understory, allow wildland fires to burn in prescribed areas, or reclaim and revegetate certain areas could impact certain resources traditionally gathered by American Indians. For this reason, the fire and vegetation management plans would be developed in consultation with concerned Indian peoples. Timely completion of a traditional use study would help guide development of future resource plans.

Although there are no known ethnographic sites in areas of proposed major development, construction projects could disturb religious activities and sites. Concerned groups would be consulted prior to initiation of such projects, and measures to protect sites and religious privacy would be developed.

## IMPACTS ON VISITORS

In compliance with the law, the preferred alternative would provide a multiagency center and a Bandera visitor center. The multiagency center would provide a local and regional information function, orienting visitors to attractions in El Malpais National Monument/National Conservation Area as well as travel opportunities in the region and those related to the Masau Trail. The Bandera visitor center would be the primary focus for interpretive activities in the monument. These two facilities would provide a quality of orientation, information, and interpretation commensurate with the high quality of similar presentations in other units of the national park system. Visitors would have the opportunity to leave the monument with an understanding of its significance. If implemented, this alternative would also establish other programs of visitor use, including education that would comply with the intent of the establishing legislation.

The preferred alternative would improve access and interpretation at the following sites: Bandera Crater area (including Dripping Lava Cave/Lava Crater, Ice Cave, Bandera Crater, Sandstone Ridge, Spattercone Valley, Cerro Bandera, and the surface features trail); the East Rendija area, including the lava wall, Big Skylight and Four-Window caves, Seven Bridges and Caterpillar collapses, and the proposed campground; El Calderon, including Junction Cave, Double Sinks, and Bat Cave; the Zuni-Acoma Trail (east side and, if an easement is acquired, the west side); Sandstone Bluffs overlook; Las Ventanas; the Narrows; and possibly McCarty's Crater. (These

sites are described in the "Visitor Services/ Interpretation Plan" section.)<sup>45</sup>

The preferred alternative would provide opportunities for the average visitor (in a two-wheel drive, low-clearance vehicle) to visit four major resource areas that would not be readily accessible in the minimum requirements alternative – Dripping Lava Cave/Lava Crater, East Rendija, Las Ventanas, and the Narrows. The preferred alternative would also disperse use within the monument and give most visitors more opportunities to see firsthand the size and diversity of El Malpais. With dispersed use, visitors should have more frequent opportunities for solitude. The larger number of recreational and interpretive opportunities should increase the visitor's length of stay at El Malpais. At least two days would be needed for visitors to experience all of the interpretive stops and trails offered in the preferred alternative. The proposed on-site activities would familiarize visitors with features that represent most of the major natural and cultural themes of the monument. Most visitors would be able to see a variety of features that complement the visitor center presentations. The hiker with additional time would have numerous opportunities to explore the diverse resources found in El Malpais.

The realignment of Route 42 would enhance the safety of visitors to the west district of the monument. The sight distance along NM 53 would be greatly improved for those motorists turning onto that highway from Route 42.

## **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of the preferred alternative would result in a number of social and economic impacts to the area surrounding El Malpais National Monument. A major effect of the plan on the socioeconomic environment would be added expenditures by monument visitors in local

communities. Although it is currently not possible to determine an exact dollar impact of the creation of the monument on the local economy, expenditures associated with tourism and recreation could be substantial.

The local economy would also receive indirect benefits from visitor expenditures. The amount of money spent by tourists in a given area can be expected to be respent (or multiplied), thus creating additional input to the local economy. Research has determined that regional multipliers for expenditures on recreation-related goods and services have averaged about 2.0 for the past two decades (Walsh 1986). There is little indication that this trend will change in the near future.

Increases in local tourism could also benefit the economies of Indian tribes whose lands are near El Malpais. As visitors to El Malpais receive information on local tourism programs, more of them will likely visit adjacent communities like Acoma, Laguna, Ramah, and Zuni.

A second impact on the economy is the number of people who would be employed by the monument and the expenditures they make locally. The preferred alternative projects that the equivalent of 10.3 additional FTEs (see "Staffing" section) would be employed at the monument. The expenditures of these individuals and their families can also be expected to multiply several times.

Some of the positions (both permanent and seasonal) could be filled by qualified individuals from the immediate El Malpais area. Additionally, new private sector jobs could be created as monument visitation increases. For example, one study has found that three to four additional jobs are created in the local area for every 10 park/monument jobs (Dean et al. 1978). These new private sector jobs arise from the indirect effect of government expenditures on monument payroll and maintenance and from the expenditures of visitors at local businesses. Any new jobs, monument or

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45. To briefly refresh the reader's memory, the Bandera Crater area offers the best opportunity in the monument for seeing the greatest diversity of lava surface features, including Dripping Lava Cave (with its unusual dripping lava formations, the largest tube in overall proportions in El Malpais), the Ice Cave, and Bandera Crater (the largest and most impressive crater in the monument). Cerro Bandera is the highest point in the monument and offers a panoramic view of a vast volcanic region from the top. The ambience and history behind the trading post complex in the Bandera Crater area is also unique. The lava features at East Rendija are distinctly different from but complementary to the volcanic features at the Bandera Crater area.

private sector, could serve marginally to decrease the local unemployment rate.

Additional economic inputs could be expected from the construction of monument facilities. The development of monument facilities would be accomplished through construction contracts that would be awarded through a competitive bid process. Local companies would be eligible to submit proposals through this process, and if selected could accrue financial gains that would add to the local economy. If nonlocal firms win construction contracts, the economy would likely receive benefits through expenditures on lodging, meals, supplies, and incidental items. It should be noted that any economic impacts resulting from the construction phase of monument development would be relatively short-lived in duration.

Annual expenditures for supplies and other monument operation needs would also provide an economic benefit to the El Malpais area. Although many supplies would be procured through centralized government contracts with out-of-area businesses, some items would have to be purchased in the local communities. The monument would also require services such as telephone, electricity, and garbage removal from local providers.

Because the National Park Service would lease privately owned office and storage space in Grants, these additional expenditures would also benefit the local economy.

An increase in the number of visitors to the area could necessitate improvements to the infrastructure of local communities (such as street improvement or expansion of the water and sewage systems). These improvements might require an initial capital outlay, but should be offset in the long term by an increase in tourism expenditures. An increase in tourism might also require hiring additional civil servants (police officers, street maintenance workers, etc.) to ensure that community services are maintained at appropriate levels.

Surveying and identifying the boundary would aid in the protection of monument resources and help control potential illegal woodcutting, hunting and poaching, and potential disputes with adjacent landowners.

The proposed boundary adjustment in the area of the multiagency center site would cause the withdrawal of that land immediately adjacent to the I-40 corridor from possible future private development. Because of its proximity to the interstate, this land could have considerable potential for the development of commercial establishments such as restaurants, service stations, or motels. However, there are other lands adjacent to or very near I-40 in the Grants area that have equal potential for commercial development.

## IMPACTS OF THE MINIMUM REQUIREMENTS ALTERNATIVE

### INTRODUCTION

This section evaluates the impacts of implementing the minimum requirements alternative, including impacts on the natural and cultural environments, impacts on visitors, and impacts on the socioeconomic environment.

### IMPACTS ON THE NATURAL ENVIRONMENT

Because implementation of the plan of natural resource and wildlife management would be the same under the minimum requirements alternative, the impacts would be the same as for the preferred alternative.

#### General Impacts from Development and Visitor Use on the Natural Environment

General impacts from development and visitor use would be the same as for the preferred alternative except that there would be less development and therefore less impact. Construction and use of facilities associated with the minimum requirements alternative would impact approximately 17 acres or .01 percent of the monument.

#### Impacts on Geological Resources

Except for impacts described below, impacts on geological resources would be the same as under the preferred alternative. Because there would be no new development at East Rendija, El Calderon, Las Ventanas, the Narrows, or McCartys Crater viewpoint, there would be no new impacts to bedrock at these sites.

**Bedrock.** Under this alternative, there would be less impact on bedrock because of less development being proposed. Site-specific impacts are described below.

**Multiagency Center** – Impacts on geologic resources would be the same as for the preferred alternative.

**Bandera Crater/Lava Crater Area** – Paving the existing two-way graded road south from NM 53 to the alternate visitor center site and realigning the southern portion of the road toward the east would result in new disturbance of a layer of cinder on sandstone/limestone bedrock over a distance of .2 miles. The southern realigned portion would be on slopes, requiring side-hill excavation of the underlying sedimentary bedrock to a maximum depth of 3 feet (but probably averaging 2 feet), thereby removing about 350 cubic yards, which would probably be used as fill elsewhere during construction in order to balance material. The result would be long, 1- to 3-foot-high cuts exposing light-colored bedrock over a distance of .2 mile along the lower western slope of Sandstone Ridge. Including the .4-mile road between NM 53 and the proposed residential/maintenance areas, the .8-mile exit road from the trading post to NM 53, and the proposed parking areas, a total of 3.9 acres of bedrock would be disturbed. The new parking area at the visitor center would be on more than one level and also would be bordered on its up-slope side by cuts of similar appearance. The visitor center would be in similar terrain and require disturbance of an unknown volume of cinder and underlying sedimentary bedrock.

The residential and maintenance areas, totaling 2.1 acres, would be disturbed by construction, landscaping, and trenches for power, water and sewer lines, and treatment fields. The cinder and other bedrock underlying this area would be removed to depths up to 6 feet, and most would be used for backfill and landscaping in the construction sites.

Impacts of trail construction under this alternative include the following:

Replacing the stairway into the Ice Cave and addition of a handicap viewing area would require removal of small quantities of basalt bedrock to level platform areas and drill holes for structural support.

Regrading and slight realignment of the existing trail to the Ice Cave to make it wheelchair-accessible and of an even grade would require removal of about 50 cubic yards of basalt bedrock. Using portions of the existing routes would be a significant mitigating factor in reducing disturbance to geologic features.

Stone steps into Dripping Lava Cave would be made of loose boulders gathered in the local area, disturbing surface rocks and possibly talus slopes. Fragile “lavacicles” hanging from the walls and ceilings of the cave could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**Zuni-Acoma/Acoma-Zuni Trail** -There would be no impacts on geologic resources at either the west or east ends.

**Sandstone Bluffs** – Provision of a wheelchair-accessible trail between the parking area and the higher sandstone ledges at the top of the cliffs would require installation of a stone or cement surface that is visually compatible with the area. The only possible disturbance of rock would be drilling holes in the sandstone to support the interpretive signs.

**Ice Caves and Lava Tubes.** Proposed research, monitoring, and protection of lava tubes and ice caves would help preserve fragile geologic and hydrologic features.

### **Impacts on Soils, Vegetation, and Wildlife**

Impacts from implementation of the minimum requirements alternative would result in similar impacts on vegetation, soils, and wildlife as described under in the preferred alternative except that the monumentwide area of disturbance would be less (see table 14). Under this alternative about 17 acres would be impacted, which is .01 percent of the total monument; however, about half of those 17 acres would be revegetated. Because no new facilities are proposed for East Rendija, McCartys Crater, Braided Cave, the Zuni-Acoma Trail (west end), Las Ventanas, the Narrows, or El Calderon

there would be no new impacts on soils/vegetation/wildlife/wildlife habitat in these areas.

Because the development would be the same under this alternative as under the preferred alternative, impacts at the multiagency center site, Acoma-Zuni Trail (east end), and the roadside kiosk along NM 117 would be the same.

**Bandera Crater/Lava Crater Area.** Impacts would be similar to the preferred alternative except the area of impact would be less, about 6 acres instead of 25.5 acres. Developing the area immediately east of the Candelaria trading post for the visitor center and using the existing access would limit most construction impacts to areas that have been previously disturbed. Impacts to Dripping Lava Cave would be minimal because it would not be developed as a major visitor attraction.

**Sandstone Bluffs Overlook.** The existing Sandstone Bluffs access road would not be paved under this alternative. Minor realignment of an existing sharp curve would result in less than 1 acre of disturbance to grass/shrubland vegetation.

### **Impacts on Threatened and Endangered Species**

No known adverse effects on federal or state endangered or threatened species would occur from implementation of this alternative.

### **Impacts on Water Resources**

impacts on water resources would be the same as for the preferred alternative.

### **Impacts on Floodplains and Wetlands**

No facilities or visitor use areas are proposed in floodplain or wetland areas; therefore there would be no impacts.

### **Impacts on Air Quality**

Impacts on air quality would be the same **as** for the preferred alternative; however, the lower scale of development would result in less air quality degradation.

## Impacts on Visual Quality

The impacts on visual quality under this alternative would be significantly less compared to the preferred alternative because there would be less development—there would be no new development at East Rendija, Braided Cave, Las Ventanas, the Narrows, and McCartys Crater viewpoint. In the Bandera Crater area there would be less development; however, retention of Route 42 on the east side of Cerro Bandera would result in continued sight of vehicles and dust along this segment by visitors on the Bandera Crater trail.

## Impacts on Audio Quality (Natural Quietness)

With less development proposed than under the preferred alternative, short-term, construction-related noise would be significantly less. As under the preferred alternative, increased visitor use in developed areas would result in more noise.

## IMPACTS ON THE CULTURAL ENVIRONMENT

Because implementation of the plan for cultural resource management is the same under the minimum requirements alternative, the impacts would be the same as under the preferred alternative.

### General Impacts from Development and Visitor Use on the Cultural Environment

General impacts of development and visitor use on cultural resources presented in the preferred alternative are also applicable to this alternative for the sites with the same proposed development: they will not be repeated here. The one exception would be less staff and therefore less deterrent to illegal looting and vandalism. Because the minimum requirements alternative proposes less development, there would be fewer overall impacts, primary and secondary, on cultural resources.

### Site-Specific Impacts on the Cultural Environment

**Multiagency Center.** Impacts would be the same as under the preferred alternative.

**Bandera Crater/Lava Crater Area.** Construction of the new visitor center immediately east of the existing trading post complex would disturb about the same acreage as under the preferred alternative. Construction of the maintenance and housing facilities would occur on the same site for both alternatives, and the impacts would be the same. Construction might affect unknown subsurface archeological resources at the visitor center and residential area sites by disturbing and compacting soils, damaging artifacts, and irreversibly altering the context of buried archeological remains,

In this alternative, new roads and trails would be fewer in number and in length than under the preferred alternative, disturbing about 3 acres less terrain, and there would be fewer impacts. Total ground disturbance for all developments at the Bandera Crater area is estimated at 6 acres. All cultural resources investigations, evaluations, and mitigations, including consultations with the State Historic Preservation Office and American Indians (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

Although they would not be removed under this alternative, the abandoned sawmill site, dumps, and ruins of cabins in the Bandera area would be investigated and documented prior to increased visitor activity.

Old trails and ways as well as recorded and unrecorded archeological sites might be impacted by continued visitor use in the area. These impacts would be assessed by surveys, mapping, and evaluation of the sites.

Treatment and adaptive use of the historic trading post complex in the vicinity of Bandera Crater would be the same as under the preferred alternative with the exception that no cabins would be adapted for use as restrooms. Careful site design, section 106 compliance, and consultation with American Indians would be the same as under the preferred alternative. However, because the new visitor center would be closer to the historic structures at the trading post, special attention to site and building designs would be needed. Despite such mitigations, the large volume of use, including increased parking area capacity for both the visitor center and the trading post/crater/Ice Cave area

would tend to concentrate more visitors close to the trailhead and could affect the historic ambience in the area.

**Zuni-Acoma/Acoma-Zuni Trail.** There would be no new impacts to the Zuni-Acoma Trail (west end) under this alternative. Impacts and mitigating measures for the Acoma-Zuni Trail (east end) would be the same as under the preferred alternative.

**Las Ventanas/Sandstone Bluffs.** Under this alternative, no new impacts are expected, except that the access road would be closed at night to help protect sites and ensure privacy for American Indian religious activities. Consultation with American Indians would continue in order to protect sites from visitor impacts.

Las Ventanas is on the National Register of Historic Places, and measures for protecting and managing this area would be included in discussions with the State Historic Preservation Office.

**Roadside Kiosk Along NM 117.** Impacts would be the same as under the preferred alternative.

### **Impacts on Museum Collection**

The monument's museum collection, including new storage space, would be managed and protected in the same way as described in the preferred alternative; therefore the impacts would be the same.

### **IMPACTS ON AMERICAN INDIANS**

The impacts on American Indians would be the same as under the preferred alternative.

### **IMPACTS ON VISITORS**

This alternative (like the preferred) would provide a multiagency center and a Bandera Crater visitor center. The impacts on visitors at these two centers would be the same as under the preferred alternative.

Under the minimum requirements alternative, the Bandera Crater area (including only the Ice Cave, Bandera Crater, and a surface features trail) and

Sandstone Bluffs overlook would be the only two major improved and interpreted sites available, and most visitors would have little chance for solitude because of the concentration of visitors at these two areas. Access to Dripping Lava Cave, the East Rendija area, the El Calderon area, and the Narrows would be possible by existing roads (high-clearance vehicles only) or primitive trails. The Corral road would remain open and the El Calderon road that accesses the national conservation area south of the monument boundary would not be improved, i.e., access would continue to be by the existing roads, which are often muddy in the winter. Las Ventanas, one of the monument's most significant cultural sites and an important primary visitor opportunity under the preferred alternative would not be accessible to the general public. Overall, under this alternative access would be provided to fewer resources. The hiker who is willing to commit time would have numerous opportunities to explore the diverse resources of El Malpais. However, most visitors would have far less exposure to the resources necessary to complement the visitor center presentations in conveying the primary interpretive themes of the monument.

Compared to the preferred alternative, the visitor experience in the Bandera area would be far more directly oriented to the Ice Cave and Bandera Crater, and the visitor would enter quickly from NM 53 and almost immediately be at the main resource, with no time to approach the trading post area over a special road that allows for leisurely viewing of the volcanic terrain in the area. Also, fewer trails would be available; visitors wishing to see Dripping Lava Cave would be required to hike over a long primitive trail.

The preservation of Route 42 along its existing alignment would result in no new impacts; the minimal sight distance for motorists turning onto NM 53 from Route 42 would continue.

### **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of this alternative would result in socioeconomic impacts that are similar to those described under the preferred alternative. The minimum requirements alternative would require a staff increase of only 3.7 FTEs (6.6 less than under the preferred). Thus, expenditures in the local

communities by monument employees would be proportionately less.

The minimum requirements alternative also proposes a somewhat lower level of visitor facilities as compared to the preferred alternative. This might result in fewer recreationists being attracted to the monument or in visitors staying for shorter periods of time. The effect would be a proportional decrease in the magnitude of economic benefits received from tourism expenditures.

## SUMMARY OF IMPACTS

The following table presents a summary comparison of the impacts of the two alternatives.

**TABLE 15: SUMMARY COMPARISON OF IMPACTS**

<b>Preferred Alternative</b>	<b>Minimum Requirements Alternative</b>
<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>	<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>
Various studies and monitoring programs would provide information for more efficient management of the monument's natural resources.	Same as preferred
Detailed action plans would enable managers to perpetuate the fauna and flora as part of a total ecosystem; baseline data would help managers identify future changes and avoid adverse impacts to monument resources.	Same as preferred
More staff would be available for patrols and resource protection.	Less staff available and less protection than under preferred.
<b>Impacts on Geological Resources</b>	<b>Impacts on Geological Resources</b>
Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 4,750 cubic yards of bedrock covering 13 acres.	Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 1,300 cubic yards of bedrock covering 2.1 acres.
<b>impacts on Soils/Vegetation/Wildlife</b>	<b>impacts on Soils/Vegetation/Wildlife</b>
Removal of 63 acres of soils/vegetation and wildlife habitat would affect only .05 percent of the monument. About 30 acres would be restored to natural conditions. Disturbed areas would be susceptible to invasion of exotic species. Wildlife impacts would be localized and temporary, with no significant long-term effects. With closure of Bat Cave to visitors, bat habitat would be better protected.	Impacts would be similar to the preferred, but less in degree and in fewer areas. Removal of 17 acres of soils/vegetation would affect only .01 percent of the monument. About 8 acres would be restored.
Careful site design and revegetation would minimize impacts on soils, vegetation, and wildlife.	Same as preferred
Reclamation of cinder pits and vehicular ways would reduce erosion and restore native vegetation.	Same as preferred
<b>Impacts on Threatened and Endangered Species</b>	<b>impacts on Threatened and Endangered Species</b>
No impacts on known federal or state endangered or threatened species.	Same as preferred

### **Impacts on Water Resources**

Temporary impacts on surface water quality during construction and minor impacts of groundwater because of long-term consumption.

### **Impacts on Floodplains and Wetlands**

No impacts.

### **Impacts on Air Quality**

No impact on overall air quality; short-term dust and fumes during construction. Monitoring air quality would provide the information necessary to maintain the monument's class II air quality.

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design). Overall improvement because of the closure and revegetation of the cinder pits and vehicular ways.

Realignment of northern part of Route 42 would eliminate visual impacts of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Minor short-term noise from facility construction.

### **IMPACTS ON CULTURAL RESOURCES**

Construction potentially affecting unknown archeological resources, to be mitigated by surveys, site avoidance, etc. Overall, development would have few impacts. Impacts of use to be mitigated by careful design, site monitoring, public education, and law enforcement. More staff would help deter looting and protect resources.

Consultation with American Indians would improve decisions about development, resource protection, interpretation, and use. Effective communication between the Park Service and American Indians would help resolve conflicts, establish trust, and perhaps create new methods of NPS management. Temporary closure of some areas would ensure American Indian religious privacy. Access ensured for subsistence activities.

Collections would be stored consistent with NPS policies, secure from theft, fire, and other adverse environmental conditions.

Sites vulnerable to looting, vandalism, and ordinary visitor activities would be identified and prioritized for protection.

Interpretation of cultural landscape concept would elicit visitor assistance in resource protection.

### **Impacts on Water Resources**

Same as preferred

### **Impacts on Floodplains and Wetlands**

Same as preferred

### **impacts on Air Quality**

Same as preferred

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design), but less than under preferred. Overall improvement because of the closure and revegetation of cinder pits and vehicular ways.

No realignment of Route 42; continued visual impact of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Same as preferred, although less because of less development.

### **IMPACTS ON CULTURAL RESOURCES**

Same as preferred except less potential for disturbance to archeological resources. Less staff available and less protection available than under preferred.

Same as preferred

Same as preferred

Same as preferred

Same as preferred

Adaptive use of trading post complex would support long-term preservation of this historic resource.

Same as preferred

Option 1: Minor impacts at Las Ventanas site. Consultation with Acoma, surveys, careful design, and patrols would minimize impact. Consultation with the State Historic Preservation Office would also take place.

No impact

Option 2: Removal of backfill from the tower kiva at Las Ventanas could diminish its integrity and significance, would be costly, and would contribute to deterioration of structural elements and artifacts. Mitigation would include consultation with Acoma and the state of New Mexico and implementation of historic preservation studies and procedures.

No impact

Eventual survey and evaluation of the total monument resource would enable managers to formulate the most practicable protection strategies.

Same as preferred

### IMPACTS ON AMERICAN INDIANS

### IMPACTS ON AMERICAN INDIANS

Visitors might unintentionally intrude on American Indian traditional activities, trespass on Indian lands, or disturb significant cultural sites. Mitigation could include monitoring, closure, education/information programs, and consultation with concerned groups.

Same as preferred

Resource management plans could affect resources traditionally used by Indians. Traditional use studies and consultation would help guide resource management. Construction projects could disturb religious activities and sites. Consultation and measures to protect sites and religious privacy would occur prior to construction.

### IMPACTS ON VISITORS

### IMPACTS ON VISITORS

High quality orientation, information, and interpretation would provide the public a safe and enjoyable visit and ensure an understanding of the monument's significance. Two visitor centers to initiate the visitor experience and nine developed areas with trails, overlooks, and waysides covering many features and themes would be available.

Same as preferred, except only two developed areas with structured activities would be available. Most visitors would be denied access to the highly significant Las Ventanas site.

Would disperse use in several areas and give visitors opportunities for both structured experiences and solitude.

Most visitor use would concentrate at **Bandera** Crater and Sandstone Bluffs where there would be more crowding and less opportunity for solitude.

Safer built environment for visitors at several sites.

Same as preferred, but fewer sites.

Primitive campground for longer-term visitors who want to explore the backcountry.

No campground available.

Route 42 improvement would make access to East Rendija safer and more reliable. Passenger cars would be able to reach East Rendija.

Continued unreliable access for motorists on Route 42, depending on fair weather. Only high-clearance vehicles could reach East Rendija.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Increasing expenditures by monument visitors in local communities.

10.3 additional full-time-equivalent employees plus families would increase expenditures in the local communities.

Some NPS employees hired from the local area if qualified.

New private sector jobs would result.

Financial gains to local companies from possible construction awards or from local expenditures by other contractors. These would be short-term benefits.

Local expenditure for leased office space in Grants.

About 54 additional acres north of multiagency center site would not be available for commercial development.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Same as preferred, however fewer visitors and less economic benefit to communities from tourist expenditures.

Only 3.7 additional full-time-equivalent employees plus families would benefit local economy.

Fewer NPS employees hired.

Fewer private sector jobs would result.

Same as preferred, but fewer contracts and expenditures.

Same as preferred

Same as preferred

# WILDERNESS SUITABILITY STUDY

## INTRODUCTION

The purpose of wilderness designation, which is accomplished solely by congressional action, is to preserve and protect wilderness characteristics and values over the long term while providing opportunities for solitude and unconfined recreation. With passage of the 1964 Wilderness Act (16 USC 1131 et seq.), Congress declared that it is national policy to secure for present and future generations the benefits of enduring wilderness resources.

Section 501 .(c) of the El Malpais legislation states that, "The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all roadless lands within the boundaries of the monument." The purpose of this study, then, is to evaluate and identify monument lands that possess wilderness characteristics as defined in the Wilderness Act and NPS *Management Policies*.

## WILDERNESS DEFINITION

The Wilderness Act describes and defines a wilderness area as follows:

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in the Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive

and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

## CRITERIA FOR WILDERNESS

Chapter 6 of the NPS *Management Policies*, "Wilderness Preservation and Management," states that wilderness includes

lands and waters found to possess the characteristics and values of wilderness, as defined in the Wilderness Act

lands that have been logged, farmed, grazed, or otherwise utilized in ways not involving extensive development or alteration of the landscape. (These lands will be considered for wilderness if at the time of study the effects of these activities are substantially unnoticeable or their wilderness character could be restored through appropriate management actions.)

The policies continue to say that lands will not be excluded from wilderness because of the following:

Management practices require the use of tools, equipment, or structures if those practices are necessary for the health and safety of wilderness travelers or protection of the wilderness area.

The lands contain prior rights or privileges, such as livestock grazing and stock driveways, provided these operations do not involve the routine use of motorized or mechanical equipment and do not involve development and structures to such an extent that the human imprint is substantially noticeable.

An area possesses mineral rights and may be subject to exploration and development if it is likely that the mineral rights will be

relinquished, acquired, exchanged, or otherwise eliminated in the foreseeable future.<sup>46</sup>

The lands contain underground utility lines if these lines do not require the routine use of mechanized and motorized equipment. (Areas containing aboveground utility lines do not meet wilderness criteria.)

There are historic features in an area that attract visitors primarily for the enjoyment of solitude and unconfined recreation. (An area will not qualify if it contains historic features that are considered primary visitor attractions.)

Section 501 (c) of the “El Malpais Senate Report,” July 6, 1987, provides further guidance. The report states that

It is the intention of the Committee that the National Park Service apply the same criteria for determining which lands are ‘roadless’ as would be applied by the BLM; that is, the definition of ‘road’ found in the BLM’s wilderness inventory policy should be used.

The Bureau of Land Management defines a “road” as “a vehicle route which has been improved and maintained by mechanical means to ensure relatively regular and continuous use.” The BLM definition of a “way” is “a vehicle route which has not been improved and maintained by mechanical means to ensure relatively regular and continuous use.” Therefore, areas of the monument containing vehicular “ways” as defined by the Bureau of Land Management are considered “roadless” by the intent of the Senate report.

The monument contains several vehicular routes that clearly meet the definition of a “way,” which classifies these areas as “roadless.” The ways were created to provide backcountry access for early timber and livestock grazing operations. These routes are a significant resource problem (see “The Plan for Natural Resource and Wildlife

Management” section), resulting in compacted soil and erosion problems. The ways serve no particular purpose except to provide infrequently used routes for backcountry visitors. Some are nonroutinely used by ranchers for maintaining livestock grazing operations. As previously stated, this commercial grazing, which is authorized by Congress, will be discontinued after December 31, 1997.

## INTERIM MANAGEMENT OF SUITABLE LANDS

All lands determined suitable for wilderness designation will be managed under the provisions of the Wilderness Act and NPS policies to maintain wilderness characteristics and values. Interim wilderness management will continue until designation by Congress.

Section 501 .(c) (2) of the El Malpais establishing legislation states

Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary [of the Interior], through the Director of the National Park Service, shall manage all roadless lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System.

## BRIEF DESCRIPTION OF THE STUDY AREA

Approximately 95 percent of the monument is covered by rugged lava fields, which, along with the limited availability of water, have historically restricted human access and development and limited the exploitation of resources.

In contrast, the more accessible grass/shrubland and forested areas along the lava flow margins have historically been used and contain most of the evidence of historic development. These areas contain national and regional transportation routes

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46. The establishing legislation for the monument provided for BLM exchange of state and privately owned subsurface interests under federally owned lands including the monument. All state subsurface exchanges have been completed. Private exchanges are continuing. Interests yet to be acquired are shown on the Wilderness Suitability map. More detailed information can be found in the El Malpais **Land Protection Plan**.

including US 40, NM 117, NM 53, and Route 42; they have also been heavily grazed and, in the northwestern portion of the monument, heavily timbered. Most visual intrusions in the monument are associated with these activities and include roads and ways, buildings, overhead power and telephone lines, earthen and metal stock tanks, fences, windmills, and corrals.

The monument is bordered on two sides by designated wilderness areas -the 60,000-acre Cebolla Wilderness to the southeast and the 38,210-acre West Malpais Wilderness to the southwest. Additionally, the 17,468-acre Chain of Craters Wilderness Study Area, approximately 2.5 miles west of the monument, is under study for possible wilderness designation. All of these areas are in the national conservation area and are managed by the Bureau of Land Management.<sup>47</sup>

## WILDERNESS SUITABILITY

Using the wilderness criteria previously described, an evaluation of the monument was conducted by the Park Service, and approximately 95,811 acres or 83 percent of the monument was found to possess wilderness characteristics and values (see Wilderness Suitability map). The suitable areas include large portions of the major lava flows, including the McCartys, Laguna, and Bandera flows and contain no permanent improvements, have only minor human impacts, and provide outstanding opportunities for solitude and unconfined recreation. They also contain important ecological, geological, archeological, educational, scientific, scenic, or historic resources. Other acreages identified as suitable are the lava fringe areas along the southwestern monument boundary that adjoin the West Malpais Wilderness Area, forming an adjacent NPS/BLM wilderness boundary.

Monument lands that do not possess wilderness qualities and values and have been determined unsuitable for wilderness designation include approximately 19,076 acres or 17 percent of the monument. These areas include the following:

The 1089.70-acre noncontiguous multiagency center site<sup>48</sup> just south of I-40 near Grants – This site does not meet wilderness criteria because of nearby development and small size.

Approximately 152 acres of lands adjacent to roadways – Setbacks in these areas define the wilderness suitability boundary. The setbacks limit visual and audible intrusions while allowing for road improvements and realignments. The setbacks will vary with the type and standard of road, including 300 feet from centerline of paved roads, 100 feet from centerline of high-standard dirt or gravel roads, and 30 feet from centerline of low-standard dirt roads.

The road corridor to Cerro Encierro, which encompasses approximately 17 acres – This road provides administrative and public access to the monument's otherwise inaccessible southwestern Laguna lava flow. The road is necessary for fire, search-and-rescue, and resource management operations. It also provides a primitive vehicular recreational opportunity unavailable elsewhere in the monument.

Approximately 17,815 acres of the lava fringe areas – These areas include proposed development sites such as East Rendija, El Calderon, Sandstone Bluffs, Las Ventanas, the Zuni-Acoma/Acoma-Zuni trailheads, the Narrows, and McCartys Crater viewpoint. This acreage also contains most of the roads that provide motorized access for monument protection and management, American Indian subsistence and religious purposes, and ranching operations (to be discontinued by 1998).

## POTENTIAL WILDERNESS ADDITIONS

Potential wilderness lands are those areas surrounded by or adjacent to wilderness that meet the criteria and would be suitable for wilderness

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47. For a detailed description of monument resources see the "Affected Environment" section of this document.

48. With the proposed boundary adjustment, this figure would be approximately 484 acres.

designation if in federal ownership. However, because these lands are not currently in federal ownership and because federal acquisition of these private lands may or may not become a reality, these lands are identified as potential wilderness additions for the purposes of this study only. The Park Service will try to work cooperatively with these landowners to protect the wilderness qualities of their lands. Within the boundaries of El Malpais National Monument there are approximately 18,079.53 acres of private lands, 10,925 acres of which are potential wilderness additions (see Wilderness Suitability map).

### IMPLICATIONS OF MANAGING LANDS IDENTIFIED AS SUITABLE FOR WILDERNESS<sup>49</sup>

As previously described, all lands that have been found suitable for wilderness designation will be managed as wilderness until such time as Congress specifically designates wilderness at El Malpais National Monument. This entails the closure of all ways and ensures no use of motorized or mechanical equipment, including mountain bikes, motorcycles, and chain saws (by both visitors and monument staff). Travel will be by foot, horseback, or pack animal only. Caves with entrances in wilderness-suitable land will be managed as wilderness. Also, development within suitable wilderness will be limited to the those facilities determined necessary to carry out the objectives as defined in the Wilderness Act and NPS **Management Policies**. The construction of facilities incompatible with wilderness values or management objectives will be prohibited. (The existing intrusive and incompatible livestock ranching developments will be removed following discontinuation of grazing on December 31, 1997, provided that none of the structures are determined historic.)

Travel within the areas suitable for wilderness will be more difficult and require greater planning and effort. Elimination of routine mechanized and motorized usage will not be an inconvenience to livestock operators because existing ranching operations do not require routine mechanized or

motorized use within areas determined to be suitable for wilderness.

The establishing legislation states that traditional American Indian practices may continue in El Malpais, consistent with the Wilderness Act. The Wilderness Act excludes use of motorized vehicles and equipment in wilderness areas, and nonexclusive access will be by foot, horseback, or other types of pack animals. Certain locations within the areas suitable for wilderness may be periodically closed to the general public for short periods for American Indian purposes. (Coordination with the superintendent will be necessary to arrange such closures.) Otherwise, there are no important differences in the ways American Indians may use lands suitable for wilderness in the national monument. It should be noted that, with few exceptions, most of the area suitable for wilderness has no roads, so designation as wilderness-suitable lands should not change traditional use patterns.

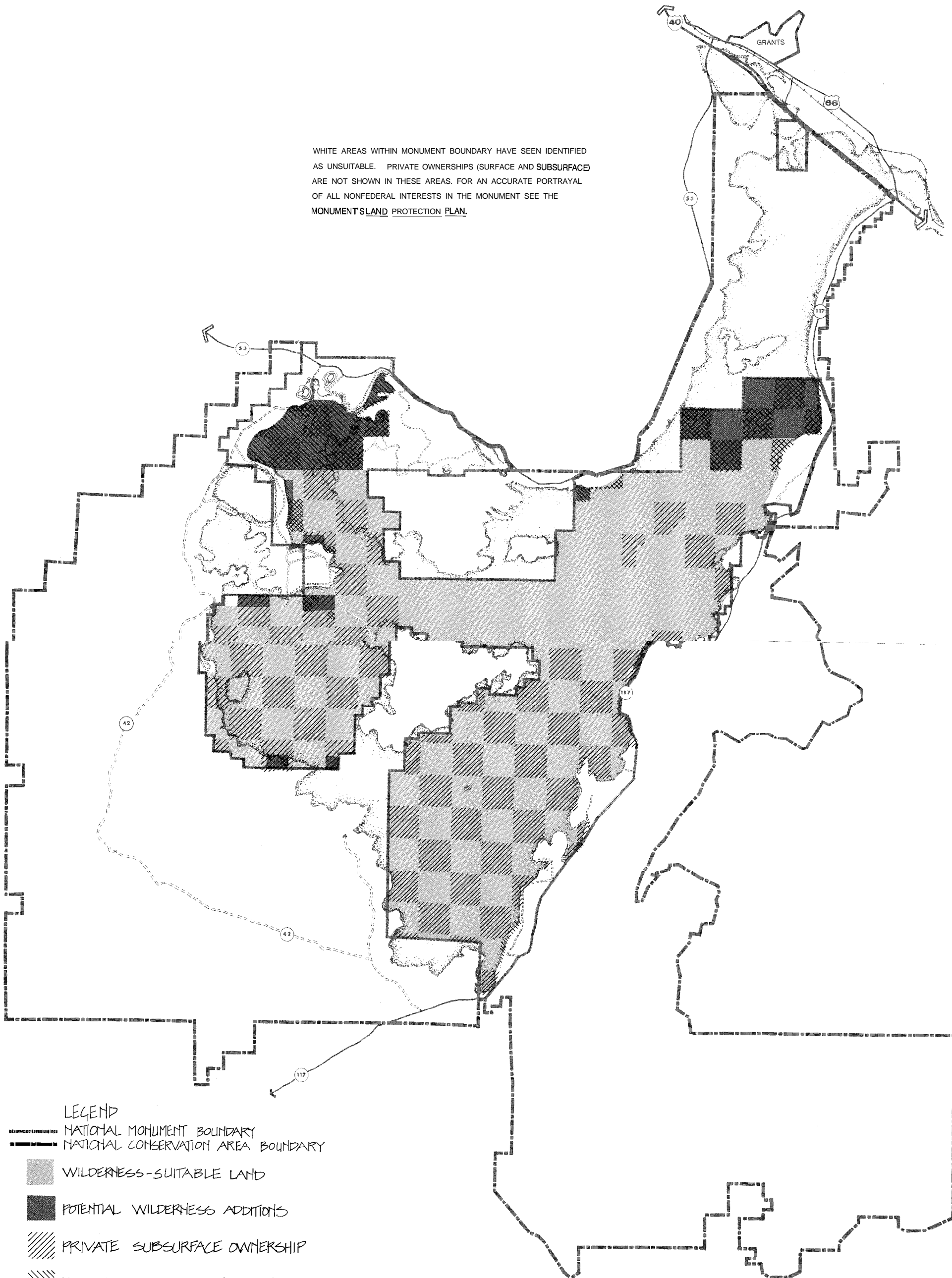
Research scientists who were required to camp in wilderness-suitable areas for prolonged periods would be required to accept primitive camping conditions and use of minimum equipment. Scientists wanting to inventory and conduct other research activities, including those associated with archeology, would be restricted in their scope of work. This would include the requirements that their projects would be allowed only if there is no other alternative to their research in wilderness-suitable areas and their projects would not interfere with other uses except for short duration. Electronic monitoring devices to protect cultural resources would be allowed only if determined to be the minimum necessary tool.

The Park Service would provide public information and interpretation about wilderness values, fostering an appreciation of these values. Visitors would be required to accept the land largely on its own terms, accepting certain risks that are inherent to primitive recreation (including potential danger from adverse weather and extremely rugged terrain). NPS interpretation and safety information would partly mitigate these hazards.

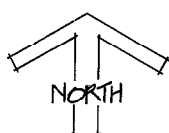
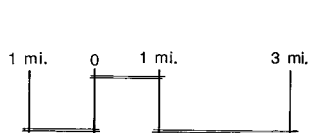
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49. Management zoning, described earlier, restricts many of the same activities and uses that the designation as wilderness suitable restricts (see appendix C).

WHITE AREAS WITHIN MONUMENT BOUNDARY HAVE BEEN IDENTIFIED AS UNSUITABLE. PRIVATE OWNERSHIPS (SURFACE AND SUBSURFACE) ARE NOT SHOWN IN THESE AREAS. FOR AN ACCURATE PORTRAYAL OF ALL NONFEDERAL INTERESTS IN THE MONUMENT SEE THE MONUMENT'S LAND PROTECTION PLAN.



- LEGEND
- NATIONAL MONUMENT BOUNDARY
  - NATIONAL CONSERVATION AREA BOUNDARY
  - WILDERNESS-SUITABLE LAND
  - POTENTIAL WILDERNESS ADDITIONS
  - PRIVATE SUBSURFACE OWNERSHIP
  - PRIVATE SURFACE OWNERSHIP
  - PRIVATE SURFACE/SUBSURFACE OWNERSHIP



## WILDERNESS SUITABILITY

EL MALPAIS NATIONAL MONUMENT

U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/DEC 1989/103/20,020 A

As described in the natural resource and wildlife management section, a wilderness management plan will be developed by the superintendent to guide the preservation, management, and use of the area. The plan will be developed with public involvement and will contain specific, measurable wilderness management objectives for the preservation of wilderness values as specified in the Wilderness Act and NPS Management *Policies*.

There may be a slight increase in visitors seeking wilderness recreation experiences; however, this increase will not significantly benefit the local economy or add to the region's recreation opportunities.

Wilderness designation, and in this case determination of lands suitable for wilderness, will help ensure long-term perpetuation of wilderness resources and values while providing opportunities for solitude and unconfined recreation. The elimination of vehicles will allow for restoration/reclamation of disturbed areas, enhance wilderness values, and increase the opportunity for solitude. For those who choose to hike or journey by horseback, opportunities for unconfined recreation will be greatly enhanced.

## CONCLUSION

Most of El Malpais National Monument lands have been found to possess wilderness characteristics and values. This amounts to 95,811 acres or 83 percent of the monument. This total includes potential wilderness additions (wilderness-suitable nonfederal lands as described above).

Based on the analysis of the suitability criteria, the following four categories of land in El Malpais National Monument have been identified with respect to wilderness suitability (see Wilderness Suitability map):

Suitable federal lands	approximately 84,886 acres
Potential wilderness addition& (suitable nonfederal lands)	approximately 10,925 acres
<b>Total suitable lands</b>	<b>95,811 acres</b>
Unsuitable federal lands	approximately 11,575 acres
Unsuitable nonfederal lands	approximately 7,536 acres
<b>Total unsuitable lands</b>	<b>19,111 acres</b>
<b>Total monument land</b>	<b>114.922 acres</b>

## **Federal**

Advisory Council on Historic Preservation  
Bureau of Land Management, Rio Puerco  
and Santa Fe Offices  
U.S. Fish and Wildlife Service, Albuquerque  
U.S. Forest Service  
Southwest Regional Office  
Cibola National Forest  
Apache National Forest

## **State**

Albuquerque Convention and Visitors Bureau  
Albuquerque Department of Economic Development  
New Mexico Department of Game and Fish,  
Santa Fe Office  
New Mexico Economic Development  
and Tourism Department  
New Mexico Energy, Mineral, and Natural  
Resources Department  
New Mexico Energy, Mineral, and Natural  
Resources Department, Parks  
and Recreation Division  
New Mexico State Highway and Transportation  
Department  
New Mexico State Historic Preservation Office  
New Mexico State Tourism Office  
University of New Mexico, Bureau of Business  
and Economic Research

## **County**

Cibola Convention and Visitor Bureau

## **City**

City of Grants  
Gallup Chamber of Commerce  
Greater Grants Chamber of Commerce

## **Indian Tribes**

Pueblo of Acoma  
Pueblo of Laguna  
**Ramah** Navajo Chapter  
Pueblo of Zuni

## APPENDIX A: ESTABLISHING LEGISLATION

PUBLIC LAW 100-225—DEC. 31, 1987

101 STAT. 1539

Public Law 100-225  
100th Congress

### An Act

To establish the El Malpais National Monument and the El Malpais National Conservation Area in the State of New Mexico, to authorize the Masau Trail, and for other purposes.

Dec. 31, 1987  
[H.R. 403]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

#### TITLE I—EL MALPAIS NATIONAL MONUMENT

##### ESTABLISHMENT OF MONUMENT

**SEC. 101. (a)** In order to preserve, for the benefit and enjoyment of present and future generations, that area in western New Mexico containing the nationally significant Grants Lava Flow, the Las Ventanas Chacoan Archeological Site, and other significant natural and cultural resources, there is hereby established the El Malpais National Monument (hereinafter referred to as the “monument”). The monument shall consist of approximately 114,000 acres as generally depicted on the map entitled “El Malpais National Monument and National Conservation Area” numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for public inspection in the offices of the Director of the National Park Service, Department of the Interior. **16 USC 460uu.**

**(b)** As soon as practicable after the enactment of this Act, the Secretary of the Interior (hereinafter referred to as the “Secretary”) shall file a legal description of the monument with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description and in the map referred to in subsection **(a)**. The legal description shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior. **Public information.**

##### TRANSFER

**SEC. 102.** Lands and waters and interests therein within the boundaries of the monument, which as of the day prior to the date of enactment of this Act were administered by the Forest Service, United States Department of Agriculture, are hereby transferred to the administrative jurisdiction of the Secretary to be managed as part of the monument in accordance with this Act. The boundaries of the Cibola National Forest shall be adjusted accordingly. **National Forest System. 16 USC 460uu-1.**

##### MANAGEMENT

**SEC. 103.** The Secretary, acting through the Director of the National Park Service, shall manage the monument in accordance with **16 USC 460uu-2.**

101 STAT.1539

the provisions of this Act, the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1 et seq.), and other provisions of law applicable to units of the National Park System. The Secretary shall protect, manage, and administer the monument for the purposes of preserving the scenery and the natural, historic, and cultural resources of the monument and providing for the public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

#### PERMITS

Animals.  
Contracts.  
16 USC 460uu-3.

SEC. 104. Where any lands included within the boundary of the monument on the map referred to in subsection 101(a) are legally occupied or utilized on the date of enactment of this Act for grazing purposes, pursuant to a lease, permit, or license which is-

(a) for a fixed term of years issued or authorized by any department, establishment, or agency of the United States, and

(b) scheduled for termination before December 31, 1997,

the Secretary, notwithstanding any other provision of law, shall allow the persons holding such grazing privileges (or their heirs) to retain such grazing privileges until December 31, 1997, subject to such limitations, conditions, or regulations as the Secretary may prescribe to insure proper range management. No grazing shall be permitted on lands within the boundaries of the monument on or after January 1, 1998.

State and local  
governments.  
Indians.

#### TITLE II-MASAU TRAIL

##### DESIGNATION OF TRAIL

Arizona.  
Federal  
Register.  
publication.  
16 USC  
460uu-11.

SEC. 201. In order to provide for public appreciation, education, understanding, and enjoyment of certain nationally significant sites of antiquity in New Mexico and eastern Arizona which are accessible by public road, the Secretary, acting through the Director of the National Park Service, with the concurrence of the agency having jurisdiction over such roads, is authorized to designate, by publication of a description thereof in the Federal Register, a vehicular tour route along existing public roads linking prehistoric and historic cultural sites in New Mexico and eastern Arizona. Such a route shall be known as the **Masau** Trail (hereinafter referred to as the "trail").

##### AREAS INCLUDED

16 USC  
460uu-12.

SEC. 202. The trail shall include public roads linking El Malpais National Monument as established pursuant to title I of this Act, El Morro National Monument, **Chaco** Cultural National Historical Park, Aztec Ruins National Monument, Canyon De Chelly National Monument, **Pecos** National Monument, and **Gila** Cliff Dwellings National Monument. The Secretary may, in the manner set forth in section 201, designate additional segments of the trail from time to time as appropriate to link the foregoing sites with other cultural sites or sites of national significance when such sites are designated and protected by Federal, State, or local governments, Indian tribes, or nonprofit entities.

## INFORMATION AND INTERPRETATION

SEC. 203. With respect to sites linked by segments of the trail which are administered by other Federal, State, local, tribal, or nonprofit entities, the Secretary may, pursuant to cooperative agreements with such entities, provide technical assistance in the development of interpretive devices and materials in order to contribute to public appreciation of the natural and cultural resources of the sites along the trail. The Secretary, in cooperation with State and local governments, Indian tribes, and nonprofit entities, shall prepare and distribute informational material for the public appreciation of sites along the trail. **16 USC 460uu-13.**

## MARKERS

SEC. 204. The trail shall be marked with appropriate markers to guide the public. With the concurrence and assistance of the State or local entity having jurisdiction over the roads designated as part of the trail, the Secretary may erect thereon and maintain signs and other informational devices displaying the Masau Trail Marker. The Secretary is authorized to accept the donation of suitable signs and other informational devices for placement at appropriate locations. **16 USC 460uu-14.**

## TITLE III—EL MALPAIS NATIONAL CONSERVATION AREA

## ESTABLISHMENT OF AREA

SEC. 301. (a) In order to protect for the benefit and enjoyment of future generations that area in western New Mexico containing the La **Ventana** Natural Arch and the other unique and nationally important geological, archeological, ecological, cultural, scenic, scientific, and wilderness resources of the public lands surrounding the Grants Lava **Flows**, there is hereby established the El Malpais National **Conservation** Area (hereinafter referred to as the "conservation area"). The conservation area shall consist of approximately 262,690 acres of federally owned land as generally depicted on a map entitled "El **Malpais** National Monument and National Conservation Area" numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for inspection in the offices of the Director of the Bureau of Land Management of the Department of the Interior. **16 USC 460uu-21.**

(b) As soon as practicable after the date of enactment of this Act, the Secretary shall file a **legal** description of the conservation area designated under this section with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular **Affairs** of the United States House of Representatives. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The **legal** description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior. **Public information.**

## MANAGEMENT

SEC. 302. (a) The Secretary, acting through the Director of the Bureau of Land Management, shall manage the conservation area to protect the resources specified in section 301 and in accordance with this Act. the Federal Land Management and Policy Act of 1976 **Animals. 16 USC 460uu-22.**

and other applicable provisions of law, including those **provisions** relating to grazing on public lands.

(b) The Secretary shall permit hunting and trapping within the conservation **area** in accordance with applicable laws and **regulations** of the United States and the State of New Mexico; except that the Secretary, after consultation with the New Mexico Department of Game and Fish, may issue regulations designating zones where and establishing periods when no hunting or trapping shall be permitted for reasons of public safety, administration, or public use and enjoyment.

Forests and  
forest  
products.

(c) Collection of green or dead wood for sale or other commercial **purposes** shall not be permitted in the conservation area.

(d) Except as otherwise provided in section **402(b)**, within the conservation area the grazing of livestock shall be permitted to **continue**, pursuant to applicable Federal **law**, including this Act, and subject to such reasonable regulations, policies, and practices as the Secretary deems necessary.

National  
Wilderness  
Preservation  
System.

#### TITLE IV-WILDERNESS

##### DESIGNATION OF WILDERNESS

16 USC  
460uu-31.

SEC. 401. (a) In furtherance of the purposes of the Wilderness Act (78 Stat. 890; 16 U.S.C. 1311, there are hereby designated as wilderness, and, therefore, as components of the National Wilderness Preservation System, the **Cebolla** Wilderness of approximately 60,000 acres, and the West Malpais Wilderness of approximately 38,210 acres, as each is generally depicted on the map entitled "El **Malpais** National Monument and National Conservation Area" numbered NM-ELMA-80,001-B and dated May 1987. The map shall be on **file** and available for inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

16 USC 1132  
note.

Public  
information.

(b) As soon as practicable after the date of the enactment of this Act, the Secretary shall file a legal description of each wilderness area designated by this Act with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be **on** file and available for public inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

##### MANAGEMENT

16 USC  
460uu-32.

SEC. 402. (a) Subject to valid existing rights, each wilderness area designated under this Act shall be administered by the Secretary, through the Director of the Bureau of Land Management, in accordance with the provisions of the Wilderness Act governing areas designated by that Act as wilderness, except that any reference in **such** provisions to the effective date of the Wilderness Act shall be deemed to be **a** reference to the date of enactment of this Act.

Animals.

(b) Within the wilderness areas designated by this Act, the grazing of livestock, where established prior to the enactment of this Act, shall be **permitted** to continue subject to such reasonable regulations, **policies**, and practices as the Secretary deems necessary, as

long as such regulations, policies, and practices fully conform with and implement the intent of Congress regarding grazing in such areas as such intent is expressed in the Wilderness Act and section 108 of Public Law 96-560 (16 U.S.C. 1133 note).

## TITLE V-GENERAL PROVISIONS

### MANAGEMENT PLANS

**SEC. 501. (a)** Within three full **fiscal** years following the **fiscal** year of enactment of this Act, the Secretary shall develop and transmit to the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural Resources of the United States Senate, separate general management plans for the monument and the conservation area which shall describe the appropriate uses and development of the monument and the conservation area consistent with the purposes of this Act. The plans shall include but not be limited to each of the following:

National  
Wilderness  
Preservation  
System.  
16 USC  
460uu-41.

(1) implementation plans for a continuing program of interpretation and public education about the resources and values of the monument and the conservation area;

(2) proposals for public facilities to be developed for the conservation area or the monument, including a visitors center in the vicinity of **Bandera** Crater and a multiagency orientation center, to be located in or near Grants, New Mexico, and adjacent to Interstate 40, to accommodate visitors to western New Mexico;

(3) natural and cultural resources management plans for the monument and the conservation area, with a particular emphasis on the preservation and long-term **scientific** use of archaeological resources, giving high priority to the enforcement of the provisions of the Archeological Resources Protection Act of 1979 and the National Historic Preservation Act within the monument and the conservation area. The natural and **cultural** resources management plans **shall** be prepared in close consultation with the Advisory **Council** on Historic Preservation, the New Mexico State Historic Preservation **Office**, and the **local** Indian people and their traditional cultural and religious authorities; and such plans **shall** provide for long-term scientific use of archaeological resources in the monument and the conservation area, including the wilderness areas designated by this Act; and

Indians.

(4) wildlife resources management plans for the monument and the conservation area prepared in close consultation with appropriate departments of the State of New Mexico and using previous studies of the area.

Wildlife.

**(b)(1)** The general management plan for the conservation area shall review and recommend the suitability or nonsuitability for preservation as wilderness of those lands comprising approximately 17,468 acres, identified as "Wilderness Study Area" (hereafter in this title referred to as the "**WSA**") on the map referenced in section 101.

**(2)** Pending submission of a recommendation and until otherwise directed by an Act of Congress, the Secretary, acting through the Director of the Bureau of Land Management, **shall** manage the

lands within the WSA so as to maintain their potential for inclusion within the National Wilderness Preservation System.

(c)(1). The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all **roadless** lands within the boundaries of the monument as established by this Act except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

(2) Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary, through the Director of the National Park Service, shall manage all **roadless** lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System, except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

#### ACQUISITIONS

Public lands.  
Gifts and  
property.  
16 USC  
460uu-42.

**SEC. 502.** Within the monument and the conservation area, the Secretary is authorized to acquire lands and interests in lands by donation, purchase with donated or appropriated funds, exchange, or transfer from any other Federal agency, except that such lands or interests therein owned by the State of New Mexico or a political subdivision thereof may be acquired only by exchange. It is the sense of Congress that the Secretary is to complete the acquisition of non-Federal subsurface interests underlying the monument and the conservation area no later than three full fiscal years after the fiscal year of enactment of this Act.

#### STATE EXCHANGES

Public lands.  
Gifts and  
property.  
16 USC  
460uu-43.

**SEC. 503. (a)** Upon the request of the State of New Mexico (hereinafter referred to as the “State”) and pursuant to the provisions of this section, the Secretary shall exchange public lands or interests in lands elsewhere in the State of New Mexico, of approximately equal value and selected by the State, acting through its Commissioner of Public Lands, for any lands or interests therein owned by the State (hereinafter referred to as “State lands”) located within the boundaries of the monument or the conservation area which the State wishes to exchange with the United States.

**(b)** Within six months after the date of enactment of this Act, the Secretary **shall** notify the New Mexico Commissioner of Public Lands what State lands are within the monument or the conservation area. The notice shall contain a listing of all public lands or interest therein within the boundaries of the State of New Mexico which have not been withdrawn from entry and which the Secretary, pursuant to the provisions of sections 202 and 206 of the Federal Land Policy and Management Act of 1976, has identified as appropriate for transfer to the State in exchange for State lands. Such listing shall be updated at least annually. If the New Mexico Commissioner of Public Lands gives notice to the Secretary of the State’s desire to obtain public lands so listed, the Secretary shall **notify** the Commissioner in writing as to whether the Department of the **Interior** considers the State lands within the monument or conservation area to be of approximately equal value to the listed lands **or** interests in lands the Commissioner has indicated the State desires to obtain. It is the sense of the Congress that the exchange **of**

lands and interests therein with the State **pursuant** to this section should be completed within two years after the date of enactment of this Act.

#### MINERAL EXCHANGES

**SEC. 504. (a)** The Secretary is authorized and directed to exchange the Federal mineral interests in the lands described in subsection (b) for the private mineral interests in the lands described in subsection (c), if—

16 USC  
460uu-44

(1) the owner of such private mineral interests has made available to the Secretary all information requested by the Secretary as to the respective values of the private and Federal mineral interests to be exchanged; and

(2) on the basis of information obtained pursuant to paragraph (1) and any other information available, the Secretary has determined that the mineral interests to be exchanged are of approximately equal value; and

(3) the Secretary has determined—

(A) that except insofar as otherwise provided in this section, the exchange is not inconsistent with the Federal Land Policy and Management Act of 1976; and

(B) that the exchange is in the public interest.

(b) The Federal mineral interests to be exchanged under this section underlie the lands, comprising approximately 15,008 acres, depicted as “Proposed for transfer to Santa Fe Pacific” on the map referenced in subsection (d).

(c) The private mineral interests to be exchanged pursuant to this section underlie the lands, comprising approximately 15,141 acres, depicted as “Proposed for transfer to U.S.” on the map referenced in subsection (d).

(d)(1) The mineral interests identified in this section underlie those lands depicted as “Proposed for transfer to Santa Fe Pacific” and as “Proposed for transfer to U.S.” on a map entitled “El Malpais Leg. Boundary, **HR3684/S56**”, revised 5-8-87.

(2) As soon as practicable after the date of enactment of this Act, the Secretary shall file a legal description of the mineral interest areas designated under this section with the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural **Resources** of the United States Senate. Such legal description **shall** have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

(e) It is the sense of the Congress that all exchanges pursuant to this section shall be completed no later than three years after the date of enactment of this Act.

#### ACOMA PUEBLO EXCHANGES

**SEC. 565. (a)(1)** Upon the request of the Pueblo of **Acoma**, the Secretary **shall** acquire by exchange any lands held in trust for the Pueblo of **Acoma** (hereinafter referred to as “**trust** lands”) located within the boundary of the conservation area which the Pueblo

Indians.  
Public lands  
16 USC  
460uu-45.

wishes to exchange pursuant to this section. Such trust lands shall be exchanged either for—

(A) lands described in subsection (c) (with respect to trust lands west of New Mexico Highway 117); or

(B) public lands of approximately equal value located outside the monument and outside the conservation area but within the boundaries of the State of New Mexico which are selected by the Pueblo of **Acoma**, so long as such exchange is consistent with applicable law and Bureau of Land Management resource management plans developed pursuant to the Federal Land Policy and Management Act of 1976.

(2) All lands selected by and transferred to the Pueblo of **Acoma** at its request pursuant to this section shall thereafter be held in trust by the Secretary for the Pueblo of **Acoma** in the same manner as the lands for which they were exchanged.

(3) Any lands west of New Mexico Highway 117 which are acquired by the Secretary pursuant to this section shall be incorporated into the monument and managed accordingly, and section 104 and all other provisions of this Act and other law applicable to lands designated by this Act as part of the monument shall apply to such incorporated lands.

(b) For purposes of acquiring lands pursuant to subsection (a) of this section, the Secretary, consistent with applicable law and Bureau of Land Management resource management plans described in subsection (a), shall make public lands within the boundaries of the State of New Mexico available for exchange. Nothing in this Act shall be construed as authorizing or requiring revocation of any existing withdrawal or classification of public land except in a manner consistent with applicable law.

(c)(1) The Secretary shall make the lands within the areas identified as “**Acoma** Potential Exchange Areas” on the map referenced in section 301 available for transfer to the Pueblo of **Acoma** pursuant to this subsection.

(2) Upon a request of the Pueblo of **Acoma** submitted to the Secretary no later than one year after the date of enactment of this Act, lands within the areas described in paragraph (1) shall be transferred to the Pueblo of **Acoma** in exchange for trust lands of approximately equal value within that portion of the conservation area west of New Mexico Highway 117. The Secretary may require exchanges of land under this subsection to be on the basis of compact and contiguous parcels.

(3) Any lands within the areas described in paragraph (1) not proposed for exchange by a request submitted to the Secretary by the Pueblo of **Acoma** within the period specified in paragraph (2), and any lands in such areas not ultimately transferred pursuant to this subsection, shall be incorporated within the conservation area and managed accordingly. In addition, any lands in that portion of the areas described in paragraph (1) lying in section 1, township 7N, range 9W, New Mexico Principal Meridian, not transferred to the Pueblo of **Acoma** pursuant to this subsection shall be added to and incorporated within the Cebolla Wilderness and managed accordingly.

Public lands.  
16 USC  
460uu-46.

#### EXCHANGES AND ACQUISITIONS GENERALLY; WITHDRAWAL

**SEC. 506. (a)** All exchanges pursuant to this Act shall be made in a manner consistent with applicable provisions of law, including this

Act, and unless otherwise specified in this Act shall be on the basis of equal value; either party to an exchange may pay or accept cash in order to equalize the value of the property exchange, except that if the parties agree to an exchange and the Secretary determines it is in the public interest, such exchange may be made for other than equal value.

(b) For purposes of this Act, the term “public lands” shall have the same meaning as such term has when used in the Federal Land Policy and Management Act of 1976.

(c) Except as otherwise provided in section 505, any lands or interests therein within the boundaries of the monument or conservation area which after the date of enactment of this Act may be acquired by the United States shall be incorporated into the monument or conservation area, as the case may be, and managed accordingly, and all provisions of this Act and other laws applicable to the monument or the conservation area, as the case may be, shall apply to such incorporated lands.

(d)(1) Except as otherwise provided in this Act, no federally-owned lands located within the boundaries of the monument or the conservation area shall be transferred out of Federal ownership, or be placed in trust for any Indian tribe or group, by exchange or otherwise.

Indians.

(2) Except as otherwise provided in this Act, and subject to valid existing rights, all Federal lands within the monument and the conservation area and all lands and interests therein which are hereafter acquired by the United States are hereby withdrawn from all forms of entry, appropriation, or disposal under the public land laws and from location, entry and patent under the mining laws, and from operation of the mineral leasing and geothermal leasing laws and all amendments thereto.

Minerals and mining.

(e) The acreages cited in this Act are approximate, and in the event of discrepancies between cited acreages and the lands depicted on referenced maps, the maps shall control.

(f) The Secretary is authorized to accept any lands contiguous to the boundaries of the Pecos National Monument (as such boundaries were established on the date of enactment of this Act) which may be proposed for donation to the United States. If acceptance of such lands proposed for donation would be in furtherance of the purposes for which the Pecos National Monument was established, the Secretary shall accept such lands, and upon such acceptance such lands shall be incorporated into such monument and managed accordingly.

(g)(1) Capulin Mountain National Monument is hereby redesignated as Capulin Volcano National Monument.

16 USC 431 note.

(2) Any reference in any record, map, or other document of the United States of America to Capulin Mountain National Monument shall hereafter be deemed to be a reference to Capulin Volcano National Monument.

(3) Section 1 of the Act of September 5, 1962 (76 Stat. 436) is hereby amended by striking the remaining portion of section 1 after “boundaries of the monument” and inserting “shall include the lands and interests in lands as generally depicted on the map entitled ‘Capulin Volcano National Monument Boundary Map’ which is numbered 125-80,014 and dated January 1987.”.

(4) Jurisdiction over federally-owned lands within the revised boundaries of the monument is hereby transferred to the National

Park Service, without monetary consideration, for administration as part of the monument.

Indians.  
Religion  
16 USC  
460uu-47.

#### ACCESS

SEC. 507. (a) In recognition of the past use of portions of the monument and the conservation area by Indian people for traditional cultural and religious purposes, the Secretary shall assure nonexclusive access to the monument and the conservation area by Indian people for traditional cultural and religious purposes, including the harvesting of pine nuts. Such access shall be consistent with the purpose and intent of the American Indian Religious Freedom Act of August 11, 1978 (42 U.S.C. 1996), and (with respect to areas designated as wilderness) the Wilderness Act (78 Stat. 890; 16 U.S.C. 131).

(b) In preparing the plans for the monument and the conservation area pursuant to section 501, the Secretary shall request that the Governor of the Pueblo of **Acoma** and the chief executive officers of other appropriate Indian tribes make recommendations on methods of -

- (1) assuring access pursuant to subsection (a) of this section;
- (2) enhancing the privacy of traditional cultural and religious activities in the monument and the conservation area; and
- (3) protecting traditional cultural and religious sites in the monument and the conservation area.

(c) in order to implement this section and in furtherance of the American Indian Religious Freedom Act, the Secretary, upon the request of an appropriate Indian tribe, may from time to time temporarily close to general public use one or more specific portions of the monument or the conservation area in order to protect the privacy of religious activities in such areas by Indian people. Any such closure shall be made so as to affect the smallest practicable area for the minimum period necessary for such purposes. Not later than seven days after the initiation of any such closure, the Secretary shall provide written notification of such action to the Energy and **Natural** Resources Committee of the United States Senate and the Interior and Insular Affairs Committee of the House of Representatives.

(d) The Secretary is authorized to establish an advisory committee to advise the Secretary concerning the implementation of this section. Any such advisory committee shall include representatives of the Pueblo of **Acoma**, the Pueblo of Zuni, other appropriate Indian tribes and other persons or groups interested in the implementation of this section.

#### COOPERATION

Indians.  
State and local  
governments.  
**Arizona**  
16 USC  
460uu-48.

SEC. 508. In order to encourage unified and cost effective interpretation of prehistoric and historic civilizations in western New **Mexico**, the Secretary is authorized and encouraged to enter into cooperative agreements with other Federal, State and local public departments and agencies, Indian tribes, and nonprofit entities providing for the interpretation of prehistoric and historic civilizations in New Mexico and eastern Arizona. The Secretary may, pursuant to such agreements, cooperate in the development and operation of a multiagency orientation center and programs on lands and interests in lands inside and outside of the boundaries of the monument and the conservation area generally, with the concurrence of the owner or administrator thereof, and specifically

in or near Grants. New Mexico, adjacent to Interstate 40 in accordance with the plan required pursuant to section 501.

#### WATER RIGHTS

SEC. 509.(a) Congress expressly reserves to the United States the minimum amount of water required to carry out the purposes for which the national monument, the conservation area, and the wilderness areas are designated under this Act. The priority date of such reserved rights shall be the date of enactment of this Act. 16 USC 460uu-49.

(b) Nothing in this section shall affect any existing valid or vested water right, or applications for water rights which are pending as of the date of enactment of this Act and which are subsequently granted: *Provided*, That nothing in this subsection shall be construed to require the National Park Service to allow the drilling of ground water wells within the boundaries of the national monument.

(c) Nothing in this section shall be construed as establishing a precedent with regard to any future designations, nor shall it affect the interpretation of any other Act or any designation made pursuant thereto.

#### AUTHORIZATION

SEC. 510. There is authorized to be appropriated \$16,500,000 for the purposes of this Act, of which \$10,000,000 shall be available for land acquisition in the national monument; \$1 million shall be available for development within the national monument; \$4 million shall be available for land acquisition within the conservation area; \$1 million shall be available for development within the conservation area; and \$500,000 shall be available for planning and development of the Masau Trail. 16 USC 460uu-50.

Approved December 31, 1987.

## APPENDIX B: SUMMARY OF PUBLIC INVOLVEMENT

Public involvement is an integral component in the formulation of any NPS general management plan. The Park Service is dependent on the public for knowledge, opinions, and advice to facilitate the success of the planning process. Public involvement for the El Malpais National Monument general management plan has been encouraged in a number of ways, including newsletters, workbooks, and public workshops, meetings, and open houses. Public input is also very important to the Bureau of Land Management. Many issues that affect planning for El Malpais influence both the national monument and the national conservation area. Thus, in most instances, the two agencies have coordinated their public involvement processes.

The two agencies have jointly printed a series of newsletters to inform the public of the progress and status of planning. The newsletters (*El Malpais Update*) have been sent to more than 800 individuals and organizations on a periodic basis. All individuals who own property in the monument or conservation area receive the *Update*, as well as area residents. Elected representatives and other public officials: local, state, and federal government agencies; American Indian and conservation groups; and anyone else who has expressed a desire also receives the newsletter. Issues of the newsletter have discussed such topics as the legislative background of El Malpais, the planning process, data-gathering activities, planning issues, safeguarding the cultural heritage, and land protection planning. The newsletters have also announced the times and locations of public meetings, workshops, and open houses.

Public meetings were held in Grants, New Mexico, on June 15, 1988, and in Albuquerque, New Mexico, on June 16, 1988, to solicit public input on the issues that should be addressed in the NPS and BLM general management plans. About 50 individuals attended these two meetings. Questions and concerns were identified in many areas, including American Indian issues, recreation, land acquisition and restrictions, wilderness and road closures, facility development, wildlife management, grazing, cultural resource management, and natural resource management. The issues identified at these meetings were

analyzed and then integrated by the planning teams into the preliminary alternatives for management of the monument and conservation area.

These preliminary alternatives and development options for the monument and conservation area were presented in the *Update* published in early December 1988. Public input on these concepts was solicited in the *Update* through the inclusion of workbooks that presented the NPS and BLM preliminary alternatives in a tabular format. This format allowed easy comparison and included a response form for the public to express their opinions on the most appropriate development and management actions. Workbooks were mailed to everyone on the *Update* mailing list.

Although the NPS alternatives were formulated in consideration of the monument as a whole, the workbook presented the specific elements of each alternative by individual geographic area. Respondents were asked to select the one alternative for each geographic area that most closely matched what they felt would be the most appropriate level of development for that area. A no-action/maintain existing conditions option was included for each area. Space was also provided for respondents to provide further comment or to suggest their own alternatives.

A total of 55 completed NPS workbooks were returned. Although this low response rate did not allow for accurate statistical analysis of the data, the workbooks did provide insight into the public's opinions on the appropriate level of development at El Malpais National Monument. Workbook responses indicated a distinct public preference for those alternatives that emphasized a higher level of facility development and a dispersal of visitor use.

On December 14 and 15, 1988, a second round of public meetings was held in Grants and Albuquerque. Open houses were also held in both cities on the afternoon prior to the actual meetings. The purpose of these open houses and meetings was to present and seek public response to the preliminary alternatives. Approximately 75 individuals attended the December meetings and open houses.

On several occasions members of the planning team met with officials of the Acoma, Ramah Navajo, and Zuni tribes to discuss in detail what tribal concerns should be addressed during planning.

Public involvement will continue to be important to the El Malpais general management planning process. Additional public meetings will be held in Grants and Albuquerque to present the draft plans and environmental assessments.

Two meetings (four workshops) were held specifically in regard to the multiagency visitor center. The results are in appendix G.

## APPENDIX C: MANAGEMENT ZONING – SUBZONING MANAGEMENT GUIDELINES

This appendix contains specific detailed guidelines for the management of subzones of the natural/cultural and monument development zones. The general management guidelines for these zones are presented in the “Management Zoning” section of this document. (A description of the visitor experience relative to the standards of access and interpretation also appears in the “Management Zoning” section.)

### NATURAL/CULTURAL ZONE

#### Primitive Subzone

**General Overview.** Visitors to this subzone will have occasional contact with other recreationists in a natural environment substantially devoid of contemporary human activity and influence. Manipulative resource management activities will be kept to a minimum. Natural processes will occur with minimum alteration or intrusion by humans. Most land that is identified as suitable for wilderness will be categorized in this subzone. The subzone will also include some land that is not classified as suitable for wilderness.

**Visitor Use.** This subzone is oriented toward the visitor who prefers a remote, wilderness-like experience. Use will be primarily by backcountry hikers. Challenge will be high.

The subzone will provide good opportunity for solitude during all times of the year. Contacts between parties will be infrequent to occasional. Evidence of recreational use will be minimal, but apparent in some isolated locations. Individual groups of monument visitors will be limited to a maximum of eight people.

The recreational use of backcountry areas in the primitive subzone will be controlled and monitored by a mandatory permit system. This system will be administered by NPS personnel at a staffed location (possibly the multiagency center or the Bandera visitor center). There will be no charge for the use permits.

All necessary rules and regulations will be communicated to visitors outside of the subzone.

No structured interpretation will occur within this subzone. Contact with NPS personnel will be minimal.

**Access.** The primitive subzone will be roadless. Existing roads and ways will be closed. Access will be by foot and other nonmotorized means only. Exceptions to this norm are detailed below. Travel will be predominantly cross-country, with some marked trails. Trails will be marked by rock cairns or by other natural, unobtrusive materials. Trails will have little or no constructed tread. Signs will be erected only where necessary to ensure the protection of resources or the safety of monument visitors. Orienteering and discovery will be encouraged in areas that can support visitor use. The hiking experience will not, in many instances, be oriented toward specific destinations or points of interest.

Access to the subzone by NPS personnel will also be limited to nonmotorized means, except in emergency situations such as fire suppression or search-and-rescue.

Grazing allottees within this subzone will be permitted reasonable motorized access along approved routes to maintain improvements (such as watering troughs, pipelines, and windmills) until the allotments expire. Motorized vehicles will not be used for routine access or herd management, although the use of horses or other pack animals will be permissible for these activities. The use of motorized vehicles will be prohibited on those federal lands in the primitive subzone that are determined to be suitable for wilderness.

American Indians may use horses and other pack animals to access areas in this subzone for the purpose of observing traditional practices of religion and subsistence activity. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious ceremonies. Consultation between the superintendent and American Indians will be necessary to arrange formal closures.

**Facilities.** No development will be present within this subzone (with the exception of permitted grazing improvements). However, some

undesirable human impacts that occurred prior to the monument's establishment may be apparent for some time.

Backcountry camping areas may be designated, however no tables, tent pads, or toilets will be provided.

## **Semi-Primitive Subzone**

**General Overview.** Visitors to the semi-primitive subzone will have low to moderately frequent contacts with other recreationists. The setting of this subzone will be such that human activity and influence will be minimal, but evident. Manipulative resource management activities will be kept to a minimum, however management actions may be required where impacts from visitors occur. Natural processes will occur with little alteration by humans.

**Visitor Use.** This subzone will be oriented toward the visitor who wishes to reach relatively secluded areas of the monument without having to hike for extended distances. Challenge will be moderate. The subzone will provide encounters with many scenic, largely undisturbed areas of El Malpais, but will not provide the wilderness type of experience available in the primitive subzone.

Off-site interpretation and education will be stressed. Personal/portable interpretive media such as trail guides and pamphlets will be developed for use in this subzone. "On-site" interpretive panels or signing will be limited to those necessary for the protection of resources or for visitor safety. Ranger-led interpretive hikes will be permissible within this subzone.

**Access.** Access to the semi-primitive subzone will be moderate to difficult and restricted to those parties who are able to negotiate rugged, low-standard roadways or those who wish to hike into the areas. High-clearance vehicles and motorcycles will be appropriate modes of conveyance. Entrance to areas within this subzone will be clearly posted as impassable to two-wheel drive sedans and other low-clearance vehicles. Motorized vehicles will be restricted to travel on clearly defined but unimproved dirt roadways. Operation of motorized vehicles off established roadways will be prohibited.

Maintenance of roadways will be limited to that required to protect the terrain and other resources or the safety of the visitor. Some roads will be periodically impassable during rain and other wet periods.

NPS personnel may use motorized vehicles within the semi-primitive subzone for routine patrol and other management activities. Use of motor vehicles by NPS staff in this subzone will be restricted to established public and service roadways, except in emergency situations such as fire suppression or search-and-rescue.

Grazing allottees within this subzone will be permitted reasonable motorized access in areas not otherwise accessible by designated public roadways. Routes crossing federally owned lands will be approved by the superintendent. Use of these routes will be restricted to activities relating to the maintenance of grazing improvements (such as watering troughs, pipelines, and windmills) until the allotments expire. Motorized vehicles may be used for routine access or herd management, provided the vehicles remain on designated public roadways. Deviations from this standard will be the exception and must receive prior approval of the superintendent. The use of horses and other pack animals for routine access and herd management will also be permissible in this subzone.

American Indians may continue traditional motorized access to this subzone for the purpose of observing traditional religious and subsistence activities. When motorized access is required to areas of the monument not otherwise accessible by auto to the general public, consultation and agreement with the superintendent on the proposed route will be necessary. American Indians may also use horses and other pack animals within this subzone for religious and subsistence activities. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange formal closures.

**Facilities:** Minor development will be allowed in this subzone when necessary for resource protection or visitor safety. Permitted grazing improvements will be allowed until allotments expire. Some improvements that occurred prior to the

establishment of the monument may be apparent for some time.

Any campsites within this subzone will be designated. Any high-use campsites (where visitor impacts require mitigation) may have fire rings as well as vault or chemical toilets.

## MONUMENT DEVELOPMENT ZONE

### Rustic Subzone

**General Overview.** Visitors to the rustic subzone will have frequent (moderate to high) contact with other recreationists during the peak-use season. Contacts will be relatively infrequent during the off season. A moderate level of resource management activity can be expected in this subzone to mitigate impacts associated with high visitor use levels. Natural processes will be maintained, but some human alterations and intrusions will be evident.

**Visitor Use.** Opportunities for solitude in the rustic subzone will be occasional to moderate during peak-season weekdays and off season weekends. Opportunities for solitude during peak-season weekends will be rare to occasional. Challenge will be low.

Visitors will be able to stay overnight in a designated rustic campground that will be designed to create a relatively high degree of solitude (although the level of seclusion will not approach that which can be experienced in the backcountry). For those who are not willing or able to manage the rigors of backcountry recreation, this subzone will provide an alternative chance to experience the natural beauty and resources of El Malpais. The subzone will also allow visitors to escape the more heavily developed and used areas of the developed subzone. Gravel roads will contribute to the perception of remoteness. Contact with NPS personnel will be moderate to frequent.

Off-site interpretation will be stressed; however low-profile outdoor exhibit panels and signs may be used at specially selected locations to provide information, ensure protection of monument resources, or provide for visitor safety. Ranger-led hikes will be permissible within this subzone.

**Access:** The rustic subzone will provide improved, gravel-surfaced roads that will be accessible by

two-wheel drive, low-clearance vehicles. Access will be moderate to easy. NPS personnel will have full motorized access to this subzone on designated public or service roadways.

Grazing allottees within this subzone will be permitted reasonable motorized access to areas not otherwise accessible by designated public roadways. Routes crossing federally owned lands will be approved by the superintendent. Use of these routes will be restricted to activities relating to the maintenance of grazing improvements (such as watering troughs, pipelines, or windmills) until the allotments expire. Motorized vehicles may also be used for routine access or herd management, provided the vehicles remain on designated public roadways. Deviations from this standard will be the exception, and must receive prior approval of the superintendent. The use of horses and other pack animals for routine access or herd management will also be permissible in this subzone.

American Indians may use motorized access to areas of this subzone for the purpose of observing traditional religious and subsistence activities. When motorized access is required to areas of the monument not otherwise accessible by auto to the general public, prior consultation and agreement with the superintendent on the proposed route will be necessary. Horses and other pack animals may also be used within this subzone to provide access to the area for religious and subsistence activities. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange formal closures.

Trails within the rustic subzone will generally conform to the standards presented for rustic trails in appendix D.

**Facilities.** Limited facility development in the form of modest interpretive shelters, low-profile interpretive panels and informational signs, trailheads, trails, and primitive vehicular campgrounds will be permissible.

Campgrounds will be accessible by automobile, however campsites will be limited to a modest size. This might limit the use of the campgrounds by larger RVs and trailers. Campsites could include fire rings, picnic tables, and vault or chemical

toilets. No potable water, electricity, or sewer connections will be provided within the campgrounds.

## **Developed Subzone**

**General Overview.** Visitors to the developed subzone will have very frequent contact with other recreationists during the peak season. Contacts will be somewhat less frequent in the off season, but will still be high compared to other areas of the monument. A high level of resource management activity can be expected in this subzone to mitigate impacts associated with high levels of development and visitor use. Natural processes will be encouraged where possible, but significant alterations or intrusions by humans are likely to be evident.

**Visitor Use.** The developed subzone will provide the primary experience for the majority of visitors to El Malpais. There will be little or no opportunity for solitude during either the peak or off seasons. Interparty contacts in this subzone will be high. Contact with NPS personnel will be frequent. Challenge will be low.

Guided tours, interpretive trails, films, slide programs, exhibits, and publications will be used to convey an understanding of the resources of El Malpais. Orientation and information will also be provided to assist visitors in planning their stay in the monument and in west-central New Mexico.

**Access.** The developed subzone may have both surfaced and unsurfaced roads. All public roads will be accessible by two-wheel drive, low-clearance vehicles. Trails will allow visitors to discover a range of environments and features. If feasible, some of these trails will allow for access by individuals with mobility impairments.

Certain areas within this subzone may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange such closures.

**Facilities.** All major facility development will be in this subzone. Comparatively significant modifications will be made to the environment;

however, as much of the natural and cultural integrity of the area will be preserved as possible. Examples of facilities that will be included in the developed subzone are visitor centers, surfaced parking areas and roads, maintenance facilities, and housing.

## **APPENDIX D: TRAIL STANDARDS AND DETAILS OF PROPOSAL TRAIL SYSTEM**

### **INTRODUCTION**

Trails in El Malpais National Monument will be built at four different standards, each corresponding to an approximate volume of use, maintenance priority, level of accessibility and skill, and the four subzone levels of visitor experience stated in the "Management Zoning" section. The standards were created to provide for public safety and offer a variety of trail experiences. Because El Malpais is a volcanic area; special lava flow trail construction strategies may be used with any of the four standards for reasons of public safety or resource protection.

### **PRIMITIVE TRAILS**

Primitive trails will be marked routes for low volumes of experienced backcountry hikers. The trails will be used for access to backcountry resources and scenic areas. There will be no feature interpretation (with the exception of self-guiding publications) and trail markers or cairns will be commonly used for direction, visitor safety, and resource protection.

Primitive trails will have the lowest priority for maintenance. Trails will have little or no tread preparation, and only minor brushing to the tread margin, where necessary. Trails will have an overall grade of less than 15 percent and normally not exceed 20 percent for distances less than 150 feet. Width will not normally exceed 2 feet. Natural lava rock, unless it is extremely rough or abrupt and potentially dangerous, may serve as the walking surface. Some upgrade of the trail standard will be permitted if the route is in an ecologically sensitive area (i.e., wetland) or crosses brutal terrain.

### **SEMI-PRIMITIVE TRAILS**

Semi-primitive trails will be hiking routes that can accommodate low to intermediate volumes of visitors who have intermediate to high ability and hiking experience. The well-marked trails will be primarily destination-oriented, serving as access to special resources and scenic areas, with minimal or

no interpretation. Trail routes will be designed to provide for visitor safety while minimizing erosion.

Semi-primitive trails are third in maintenance priority. Often, the tread will not be smooth, having a natural dirt, rock, or cinder surface, and will be no less than 2 feet wide. Vegetation will be cleared 6 inches beyond the tread margin, where feasible. These trails may use footbridges, corduroy elements, and water bars. The overall grade will be less than 15 percent and not exceed 18 percent for distances less than 150 feet. Natural lava rock will be incorporated into the alignment unless the surface is extremely rough or there are abrupt and potentially dangerous grade changes. Where these trails ascend long steep slopes, they will be aligned carefully so as to minimize the potential for hikers to shortcut switchbacks.

### **RUSTIC TRAILS**

Rustic trails can be hard-surfaced or gravel (cinder) routes that can accommodate intermediate to large volumes of visitors with average physical abilities to important attractions in the monument. Rustic trails will be well marked, and some interpretive information may be provided. They will be constructed to provide for visitor safety while minimizing erosion.

Rustic trails will have second priority for trail maintenance. Minimum tread width will be 3 feet, with the overall grade less than 10 percent and not to exceed 15 percent for distances less than 150 feet. Vegetation will be cleared 1 foot beyond the trail margin, where feasible. These trails may use footbridges, corduroy elements, and water bars, and have trail-side benches where needed. The trail tread will be relatively smooth and free of extreme variations and abrupt rock and root protrusions. Natural lava rock may be incorporated if the surface is hard and relatively smooth. Lava cinders may also be used as a trail surface. Careful attention to combine natural landscape materials and colors will always be a design and maintenance priority.

## DEVELOPED TRAILS

Developed trails are hard-surfaced and meet Uniform Federal Accessibility Standards (UFAS), accommodating large volumes of people en route to popular destinations. All developed trails will be accessible to people in wheelchairs (unassisted) and will be carefully routed and constructed. A relatively large amount of interpretive information may be presented along these trails. These trails will provide for visitor convenience and minimal degradation of the natural and cultural resources. Because these trails may be heavily used by visitors with limited physical abilities, benches and shade/rain shelters will be incorporated along the route at strategic locations.

Developed trails will be given the highest maintenance priority. These trails will not exceed 5 percent (except that ramp sections will not exceed 8 percent). Tread width will be a minimum of 5 feet on one-way loops and 6 feet on two-way trails. These trails will drain well, with a cross slope not to exceed 2 percent. Vegetation will be cleared 1 -1/2 feet beyond the tread margin, where feasible. Typical materials may include nonslip or aggregate concrete, asphalt, soil binders, boardwalks, and bridges in harmonious combination. Natural lava rock may be used for tread only if the surface texture and grade conform to UFAS. Lava cinders may be used with a translucent binder if feasible. Preference will be for natural landscape materials and colors to ensure compatibility and visual integrity.

**Table D-I. Proposed Trail System at El Malpais National Monument – Standard and Length (mi)**

<b>Area/Name</b>	<b>Developed</b>	<b>Rustic</b>	<b>Semi-Primitive</b>	<b>Primitive</b>
<u>Multiagency Center</u>				
View trail		0.5		
<u>Bandera Crater Area</u>				
Visitor center nature trail		0.5		
Dripping Lava Cave		0.3		
Lava Crater			0.5	
Sandstone Ridge			2.0	
Sandstone Ridge connector				0.8
Ice Cave**	0.2			
Lava surface features	0.5			
Bandera Crater*		0.5		
Bandera Crater connector		0.5		
Spattercone Valley				1.3
Spattercone Valley connector				1.1
Cerro Bandera connector				1.1
Cerro Bandera summit			1.0	
<u>East Rendiia Area</u>				
Lava wall			1.3	
Four-Window/Big Skylight caves			1.5	
Caterpillar/Seven Bridges collapses				1.5
<u>Braided Cave</u>				0.4
<u>El Calderon Area</u>				
Junction Cave			co.1	
Bat Cave	0.3			
Double Sinks	0.2			
Double Sinks-Junction Cave	0.2			
<u>Zuni-Acoma</u>				
Trail to overlook (west)	<0.1			
Zuni-Acoma*				7.0
<u>Sandstone Bluffs</u>	0.1			
<u>Las Ventanas</u>			1.3	
<u>The Narrows</u>				
Lava surface (wheelchair accessible)	0.1			
Lava surface (other)			0.3	
<u>McCartys Crater Viewpoint</u>			0.3	
<b>TOTALS</b>	<b>1.7</b>	<b>2.3</b>	<b>8.3</b>	<b>13.2</b>

Note: Actual length and alignment may vary from those above because of terrain factors and resource protection needs. The future backcountry management plan may identify additional primitive trails that would be added.

\* Existing, no change

■ Upgrade existing trail

## APPENDIX E: GENERAL DESIGN GUIDELINES

### INTRODUCTION

The rugged beauty and deeply rooted cultural heritage of the El Malpais landscape should be complemented by a built environment (roads and facilities) that direct the visitor's attention toward the monument's resources. The goal of these guidelines is to encourage this attention with design consistency and visual quality that communicate a sense of place, including imitation of natural landscape patterns in developed areas and minimization of disturbance to ecological and cultural resources during design, construction, and maintenance.

Because El Malpais is a new national monument with relatively few structures of any type, maximum latitude will be given to the designers to research and develop facilities that reflect sensitivity to the cultural and ecological setting -with the reservation that select architectural and landscape architectural styles be repeated in other developed areas to link the overall visual image of the monument. Any new design should also be realistic in terms of functional requirements for today's management and operational needs and, because baseline data on resources and visitation is relatively lacking, include opportunities for functional flexibility.

The following sections provide an aid to the designer, contractor, Park Service official, and maintenance staff in the decision-making process concerning visual quality, design consistency, and resource sensitivity in the built environment. Designers are also encouraged to review the "Impacts of the Preferred Alternative" section prior to initiating schematic designs. It is recognized that during actual design of roads or facilities, case-by-case variances of some of the recommendations herein may be made to effect the most practicable design solutions.

### ARCHITECTURAL ELEMENTS

Because there are no large facilities of any kind within the monument, an extensive study of regional vernacular architecture should be made prior to developing the schematic designs. Examples of regional mountain style architecture

should be considered in designing buildings in the **Bandera** area. Buildings should be sited so that existing significant views or vistas are preserved. Structures should take advantage of available views, but also consider sight lines back to the structure. Placing a structure between an established or potential approach and a significant resource should be avoided. Native vegetation should be used to screen service areas as needed.

The design of the multiagency center may differ from that of the **Bandera** visitor center, primarily because of the climatic, scenic, functional, and operational needs. Facilities within the monument should rely on solar energy, where feasible. Water conservation is important, so water-conserving appliances and irrigation should be seriously considered. The following sections elaborate on major proposed facilities.

### Major Public Facilities

The multiagency center should be built in a representative style of regional vernacular architecture. The building will be within 0.3 mile of the I-40 interchange area, lessening the expense of connecting utility lines to the city of Grants. The actual site should be adjacent to some minor variation in the otherwise flat landscape. The building's entrance should have a southwest orientation that is visible from the entrance road. Large shaded view windows should be used on southern exposures. Office windows should face the parking lot for security. A small shaded exterior public space should be designed as an element of the plaza for people to view the resource and rest.

Parking for the center should be screened from the entrance road and highway, if feasible. Native shade trees planted in large parking islands should be incorporated to relieve the intense summer heat on vehicles. Distinct spatial transitions should separate the parking area from the plaza and entrance area.

Solar orientation should be a major design factor in roof design (for possible photovoltaic cells), as should some regard for snow and heavy rain. Dense vegetative screening should be used near

the building to “seclude” it from the noisy interchange, and medium screening should be used along the right-of-way adjacent to the industrial park to break the lines of this development. A designated open vista to the south should also be available along the entrance road. Landscaping near the center should be a semi-formal mix of native plants (see Multiagency Center DCP).

The Bandera visitor center should be designed in a style representative of regional vernacular architecture. The building will be on a sparsely vegetated sandstone/volcanic cinder bench above and west of the lava flow margin. The entrance to the visitor center should have a southern exposure, and the view deck (approximately 500-600 sq ft) should face east, overlooking the lava flow, forest, Lava Crater, and Cerro Candelaria. The view deck may wrap around the building's south side.

The entrance area should be easily distinguishable and spatially distinct from the parking area. The parking area, broken into several smaller areas if feasible and located south or southwest of the building, should not interfere with the view of Lava Crater from the deck. The entrance area should have a separate small exterior public space for people to sit and relax.

Solar orientation should be used in roof design (for possible photovoltaic cells), as should a pitched roof to mitigate snow accumulation. The building should have large shaded view windows on the north, east, and part of the south side. Interior offices should have windows oriented south and west for security, and display areas should use the soft light of north-facing windows.

The trading post will be rehabilitated for orientation and meeting space. An exterior public space for relaxing should be provided in the picnic area and not adjacent to the trading post.

Site development and formal landscaping, including the proposed drop-off zone and walkways, should be subtle and not dominate the historical scene. Revegetation is needed in the trading post area. New trees, shrubs, and grasses should replicate, where feasible, the historical landscape (see “Landscape Architectural Elements”).

## Government Facilities

The residential area should be designed to encourage a sense of community among residents. Four single-family detached homes for permanent employees and one four-plex apartment building for seasonal employees will be built. Although obviously smaller in scale, the form, facade, color, materials, and texture should avoid inconsistency with the Bandera visitor center. Interior design should allow for individual family functional flexibility and views from windows. Views and roof angles (for possible photovoltaic cells) should be a prime consideration in specific site location.

Parking areas should be designed to decrease their noticeability. Landscaping for the new houses should incorporate native plants; preserve biotic diversity; define outdoor space; use native, drought-tolerant grasses for yards (each house should have its own private yard), and offer well-landscaped, distinct transitions from the parking areas to entryways. The residential area site plan should include a designated area away from the entry road for community recreation, e.g., a small turf area for volleyball, bar-be-cue, etc.

The maintenance area, within 0.3 mile of the residential area, should consist of one large building and one small storage shed. The actual site should be topographically or vegetatively screened from the residential area and the Lava Crater viewpoint, if possible. The entrance should be on the south to minimize ice on entryways, and the roof should be oriented for possible installation of photovoltaic cells. The large building should include adequate room for firetruck and ambulance parking, dry material storage, a workshop, fire equipment storage, a unisex restroom, general supply storage, and enough space for several workstations.

The paved maintenance yard should include ample parking for vehicles, including firetrucks and heavy equipment. The yard should have a truck wash area, fuel pumps, and material storage area, and be fenced for security. The yard may be of a nontraditional shape to allow for preservation of vegetation. A helicopter landing area should also be considered during design.

The water storage and delivery system -wells, storage tanks, and water treatment facilities, including access roads – should be hidden from

public view. The partial or full burying of tanks should be considered and any remaining aboveground structure should be hidden with an appropriate facade or painted with earth tone and forest colors.

## LANDSCAPE ARCHITECTURAL ELEMENTS

The design of roads, parking areas, trails, vegetation, vista clearings, and exterior public spaces should contribute as effective links between the natural form and the built form. This would be done by harmonizing the patterns and biotic diversities found in the landscape with the form, mass, scale, color, and textures of facilities. Although architectural styles may differ, signs, waysides, lighting, street furniture, trash receptacles, etc., should be similar in appearance throughout the monument. The following sections provide guidelines for major landscape elements.

### Roads

Roads in the monument will be designed to interfere as little as possible with natural processes and biotic diversity. Although the preferred alternative's various development concept plans show suggested routes, much latitude should be taken to locate the actual alignments. The alignments should allow the driver to rhythmically focus on appealing views while peripheral distractions are screened (visual sequence). An appropriate visual sequence of the alignments should include scenic vistas, primary destinations, and eventually parking. This sequence should be accomplished without the need for a stop sign for through traffic.

Interior park roads will be designed for low-speed travel (25 mph maximum). Small turnouts should be incorporated to facilitate vehicles passing on long tangents or provide parking at points of interest. Vegetation patterns along the routes should be studied, and to the extent possible, replicated in the road embankments. During the design stage, the possibility of bike lanes will be considered.

Design suggestions for several of the major public roads are listed below:

1. The junction of the multiagency center entrance road with the interchange should be easily

visible, but its junction with the parking area should be obscured from the driver heading toward the building. The road should turn toward the entrance, then curve north into the parking area. A small, bilateral roadside contact area of dense native screening will form a "gateway" to the center and help screen the parking area.

2. The junction of NM 53 with the Bandera visitor center entrance road should include deceleration/acceleration lanes. The view from the entrance road should first focus on the lava flow and ecotone, then the visitor center backdropped by Sandstone Ridge. Parking should be somewhat hidden behind the visitor center. The entrance road should meld into the one-way tour road without a stop sign but with opportunities to enter into the visitor center parking or turn around and return to NM 53. The proposed entrance road route will come close to the ecotone of aspens, pinyons, and junipers next to the west margin of the lava flow. Design alternatives should mitigate wherever possible the disruption of surface runoff patterns and the ecotone's water source.
3. The one-way Bandera tour road should be designed for low-speed (25 mph) and focus the driver's attention on views of the ecotone, the lava flow, Lava Crater, Cerro Candelaria, Cerro Bandera, Bandera Crater, and other scenic vistas. If determined feasible during design, pullouts should be added at scenic areas. The tour road should not have any stop signs until reaching NM 53, although it should have turn lanes for the Dripping Lava Cave road and the trading post parking area.
4. The Dripping Lava Cave road will be a short, two-way paved road leading to a parking area/trailhead. No pullouts should be necessary on this short road, and the parking area should be large enough to accommodate turning radii of tour buses. Widening the short road cut through the lava flow will be necessary, but careful attention to keep the cut natural looking should be specified in the design.
5. The realignment of County Road 42 (first 2 miles) should adhere to the form of the land and minimize interruption of ecological systems. Because parts of the road surface may be in the shade of Cerro Bandera during the winter

months, mitigation of snow accumulation should be considered in design and alignment.

## Parking Areas

Parking layouts, like roads, should respond to the topography in a complementary form. Even though El Malpais does not require massive parking areas, arched or curvilinear layouts and small parking areas (rather than large asphalt areas) should be used to reduce the perceived size.

Large, vegetated parking islands should visually link native vegetation patterns with the built environment. Parking islands should be designed parallel to the line of foot travel toward the main destination they serve and should be wide enough to support a variety of native vegetation. To lessen the impact of trampling by visitors, islands can be shielded by

- increasing (or decreasing) the planting grade to the soil's angle of repose

- incorporating natural barriers, e.g., rocks and dense plant materials

- using subsurface irrigation techniques and soil treatments to combat compaction

- raising the curb height from the standard 6 inches

Snowpole holders are necessary in the design of all roads, walkways, and curbs and gutters.

## Walkways

Pedestrian walkways should be spatially distinct from vehicular circulation and integrated into the landscape form. Safe walkways and paths should invite the visitor into well-defined use areas through a logical sequence of spatially distinct experiences and views; natural features should dominate where feasible. Edges of use areas should be well defined. Exterior public spaces, especially spaces adjacent to the entry of the visitor centers, should be spatially distinct and offer sitting areas, drinking fountains, and other amenities to invite the visitor to relax and enjoy the blend of the built and natural environments.

## Vegetation

Trees and shrubs grown or transplanted from the natural environment should be considered for parking islands and general landscaping. Outside sources of native forbs and grasses should be approved by the park staff prior to use in revegetation.

In any planting scheme, careful attention should be given to the immediate environs. Although similar species are found at both the **Bandera** visitor center site and the trading post area, the pattern and frequency of natural distribution will be different, especially in the lava flow margin ecotones. Imitating the immediate environs helps mitigate disturbance of biological continuity and preserve the sense of place.

In areas of snow removal, conifers should be planted back from the road's edge to minimize denuding by the heavy snow loads caused by snowplows. Because roadside encroachment by new growth may be inevitable, a transplant program for young, unneeded trees should become a standard maintenance procedure.

Vista clearings are permissible to enhance the visitor's appreciation and understanding of the natural/cultural landscape. Proposed vista clearings should be reviewed by monument managers in consultation with a landscape architect.

Several criteria should be considered when clearing a vista.

- The key view areas along roads and trails, and at other facilities should be defined.

- The area to be cleared should be viewed from the key viewing area and from the area back toward the viewpoint. This is important because vegetative screening may be necessary to block undesirable elements in the return view, e.g., parked cars and utility lines.

- All trees and shrubs do not necessarily have to be removed. A representative diversity of tree heights and species may be necessary to minimize interference with ecological and biological systems. Vegetation under a specified height (generally young trees)

should be left alone and checked for height every five years.

Abrupt forest edges next to cleared areas should be avoided; a soft, graduated blending of clearing and forest should be used. The minimum length of a clearing should be established on an individual basis.

Once the initial major facilities are designed, a more refined set of design guidelines and maintenance procedures should be prepared to further protect visual quality and resource sensitivity in the monument.

## APPENDIX F: VISITOR CENTER FUNCTIONS, SIZE REQUIREMENTS, AND INTERPRETATION DETAILS

### MULTIAGENCY CENTER

#### Functions

As described in the proposed plan, the new visitor center will contain these functional areas for public use:

- Information/reception/circulation area
- Cooperating association sales and publication display area
- Travel planning area
- Exhibit area with audiovisual (AV) units, in alcoves and/or as part of an exhibit
- AV theater
- Plaza and start of short interpretive trail
- Public restrooms

The information/reception area will contain an information desk, orientation exhibits to features and activities in the area, a sales publication display area, and identification of the different agencies involved; it will also provide circulation space for visitors coming and going from the exhibit area, AV theater, and the travel planning area. It is important that the entrances to public restrooms be located so that this function does not add congestion to the information/reception area.

The sales and publication display area will be out of the main circulation area but in eye control of information desk personnel. Storage, safe, and workspace for the association will be near the sales area, and the cash register will be at the information desk.

The travel planning area will be a self-service area/alcove off the reception/information area. Informal seating/work tables will be available for visitors developing travel plans. Basic free literature and maps covering the El Malpais, the Grants/Milan region, and the Masau Trail should be available, along with information relative to the amount of time/effort needed to visit and participate in each combination of areas or activities and relevant visitor safety and resource protection information.

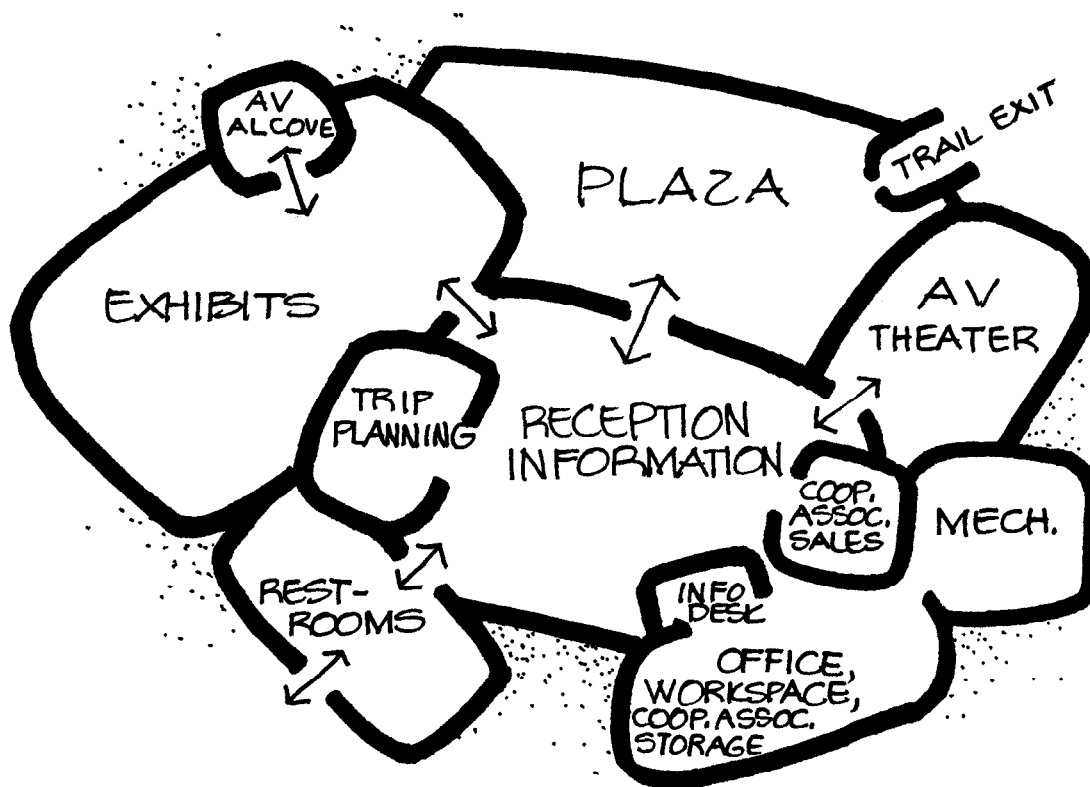
A 50-seat AV theater will be located off the reception/information area. It will be used for

showing a film about the Masau Trail as well as multiple offerings of other relevant AV programs dealing with the resources of the region.

A plaza adjoining the building, with informal seating (benches or a low wall), will serve as a meeting area for groups, a waiting area when some members of the group are using the trail or the trip planning facility, and as an informal personal services area for occasional talks and/or demonstrations by American Indian craftspeople. A short interpretive trail, for visitors to stretch their legs and get a visual orientation to the resource, will start from the plaza. Other amenities, such as a picnic area, outdoor amphitheater, and longer interpretive trails, will not be developed at the visitor center site. Instead, visitors will be directed to such facilities in the surrounding area.

A small office/working space for employees, located so that during the off season the employees manning the building can accomplish other work while also watching the information desk and sales area, will be a part of the center. An additional small office/work area/library will also be provided for employees and staff from other agencies or volunteers. This will be the limit of administrative space in the structure.

The following graphic shows the functional relationships in the public use spaces of the proposed new multiagency center.



## Size

The following square footages were determined for the various functional areas in the center.

Information/reception/circulation	1,000 sq ft
Cooperating association sales and display	300 sq ft
Association storage and work space	200 sq ft
Travel planning area	500 sq ft
Exhibits, AV alcove	2,150 sq ft
AV theater	500 sq ft
Public restrooms (2-3 stalls for males, 4 for females)	600 sq ft
Office and workspace (office = 150, workspace = 200)	350 sq ft
Mechanical	600 sq ft
<b>TOTAL</b>	<b>6,200 sq ft</b>

These figures anticipate only office and workspace for the visitor center staff; office space for the management and administrative staff of the Park Service and/or the Bureau of Land Management will be provided in Grants.

## Details of Interpretation

The opportunity to "experience the Southwest," its rugged landscapes and American Indian cultures - both prehistoric and contemporary - has long been the primary motivation for travel and tourism to this region of the country. The primary resources of the El Malpais National Monument and National Conservation Area, specifically mentioned in the establishing legislation, are the nationally significant Grants lava flow and the Las Ventanas Chacoan archeological site (the southernmost outlier site of the Chacoan culture) -the same primary motivating factors as for the Southwest in general. Therefore, the exhibit area in the visitor center will deal with the rugged landscapes and the human record of occupation from the prehistoric Chacoan and other Anasazi groups to the contemporary American Indian cultures of the area. Concentrating on these two primary interpretive themes will allow the center to present a core interpretive message applicable to the resources of the local region and the Masau Trail as well as those of El Malpais.

Masau Trail orientation exhibits will include a wall-sized stylized map of the Masau Trail, with large photo inserts of the different areas involved. Additional exhibits will be developed for each of the shorter 1- to 3-day loop routes, each focusing on a particular prehistoric cultural group and identified interpretive theme. There are eight such cultural groups identified in the preferred alternative for the Masau Trail, but there may be as many as 11 by the time the planning and trail layout is finalized.

In the interfaces of the reception area, trip planning area, and exhibit area could be large topographic relief models/graphics (orientational or interpretive) that depict

the El Malpais lava field bounded by the Cebollita Mesa on the east and the Zuni uplift and Chain of Craters on the west

the larger region – its primary landforms and resources – an area bounded by the Acoma and Laguna reservations to the east, the Ramah Navaho and Zuni reservations to the west, the Cibola National Forest and Chaco Cultural National Historical Park to the north, and the Cibola County boundary to the south

The depiction of the El Malpais lava field will be designed so that geology is a component, but the regional model/graphic unit will be primarily designed to orient visitors and interest them in traveling to the various sites depicted.

Exhibit planners and designers could keep in mind that the monument/conservation area will be changing rapidly, at least from the facilities development point of view. Initial information/ orientation panels may very well have to be changed more than once in the next five to 10 years. The same consideration holds for the Masau Trail.

Wayside exhibits will be located to interpret the resource visible from the plaza.

Outside the visitor center but protected from the weather there will be a bulletin board/information panel for posting information of a changeable nature. The need for after-hours information can be handled through this media. There will also be wayside exhibits explaining the resources, as appropriate, along the interpretive trail.

Exhibits will be produced on the following topics.

## The Land

**The Landscape** – The topographic relief model/graphics of the El Malpais area and region already described above for the interface of the reception/information area and the exhibit area could describe the landscape.

**Geology** – Geology exhibits could include lava and other rock samples and graphics coupled with video units that demonstrate the major geomorphological events that created the landscape of today and their relationships to the various destination sites in the region, the El Malpais area and along the Masau Trail. Videos could be silent, perhaps with captions, and viewed by standing visitors. (Note: this exhibit should be designed more to encourage visitors to go see the “real thing” than to actually teach much about geology, but enough information should be included to encourage site visitation.)

## The People

**Cultural Groups** – There could be an exhibit to identify the American Indian cultural groups that have occupied this area (the Masau Trail region) from prehistoric times to the present using a combination of artifacts, photographs, and graphic materials. Current reservation boundaries as compared with earlier Indian territories could also be depicted.

**Occupation History-There** could be a time duration and placement-in-history exhibit to introduce visitors to the long time span involved in the occupation and use of this area by the different cultures. The Acoma have lived in Sky City for about 800 years, in contrast to the approximate 400-year span for the entire colonial and national history of the United States; the early Anasazi cultures are even more ancient. The arrival and tenure of Europeans and the eventual BLM and NPS stewardship could be included in this time-line history. This exhibit could also place these cultural groups in world history, cross-referencing them with events that were occurring in other parts of the world (Central/South America, Europe, etc.) during the same time period.

**Chacoan Outliers** – One exhibit will present an overview of the Chaco era (A.D. 900-1150), identifying Las Ventanas as a Chacoan outlier and placing it in context with Chaco Canyon and the other 70+ Chacoan outliers in the region. This exhibit will create an awareness that Chaco Canyon (the hub of the Chaco civilization) and its outliers (detached units scattered over a 20,000-square-mile area) constituted a complex and far-reaching social, economic, and cultural system that was regional in nature and greater than the sum of its parts. The visitor will understand from the exhibit that these outliers were small communities with multistory dwellings, associated smaller (detached) dwellings, kivas, irrigation systems, connecting prehistoric roads, and signaling stations. The Las Ventanas site and features may then be contrasted with other outliers. Because there are more questions than answers, visitors may be encouraged to theorize what role Las Ventanas played in this regional system. An assortment of artifacts will support this exhibit, providing a rich visual association with this prehistoric period.

### **For the Sake of the People - For the Sake of the Land**

**A Special Place** – An alcove in the exhibit area could be used for a video program that deals with the relationships, understandings, and feelings of the different peoples for this land -this "special place." The video could be structured around a panoramic scene of the El Malpais with a number of different speakers – representatives of the Acoma, Zuni, Ramah, and Laguna tribes, the Park Service, the Bureau of Land Management, ranchers, etc. – discussing what they see, feel, and value about the land. It would not be possible to teach or even cover superficially the differing philosophies or beliefs of the different peoples and/or organizations, and no attempt should be made to accomplish this. The objective should be to produce a kind of "Whitman Sampler" to point out that there are differences and that they are all valid within their context, that we should all respect others' viewpoints, and, most importantly, that we should respect the land and the resources we share in common. This exhibit could be very specific to El Malpais and its relationship to

the region and to the Masau Trail, and this could be the overall message visitors gain from it.

The following quotes (extracted from notes taken during a meeting on October 17, 1988, between the Park Service, Bureau of Land Management, and representatives from the Acoma, Zuni, and Ramah Navaho tribes when discussing interpretation at El Malpais) are examples of the kinds of messages that this video exhibit could attempt to impart. (They are not offered as the text for the exhibit/video, but just as examples.)

"When we look we feel that region. We want respect and love to come about, for people to know that there is a quality that is awesome, significant about the land and about himself." (Acoma)

"...yes see the land and appreciate it, but know there is something else, that we share the responsibility to love it, to protect it, to respect it." (Acoma)

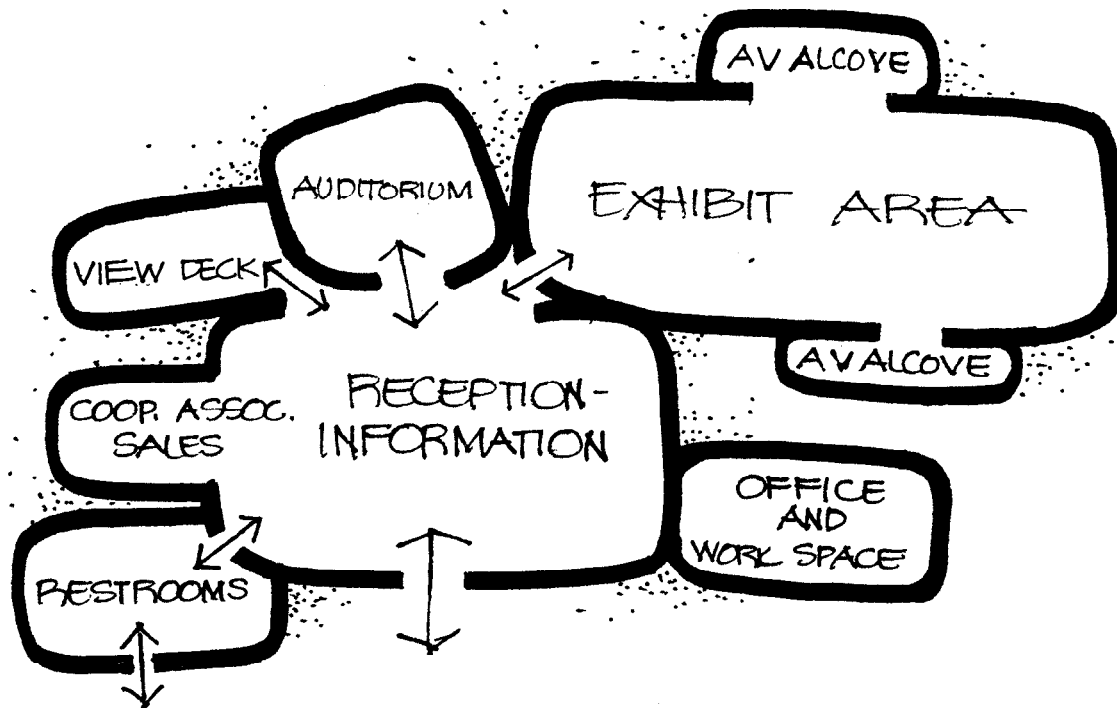
"We need to develop a sense of responsibility. For the sake of the people, for the sake of the land, make people a part of the responsibility." (Acoma)

"To learn to respect, to love the land takes a long time. Our people have been part of the land for so long; help people understand what this means." (Ramah)

"Basically we all see the same, believe the same, except for the different interpretations that come from our different cultures". (Zuni)

"This is a special place. What we want is for people to come to love it, to respect it. The land echoes in my mind, in my heart, in my spirit." (Acoma)

The program could last five minutes or less, be visitor-activated, and the alcove could be separated and buffered to prevent sound spill because of the narration.



## BANDERA VISITOR CENTER

### Function

As described in the proposed plan, the new visitor center will contain these functional areas for public use:

- information/reception/circulation area
- Cooperating association sales and publication display area
- Auditorium
- Exhibit room
- AV units, in alcoves and/or as part of an exhibit
- View deck and start of short interpretive trail
- NPS office space/workrooms and storage area
- Public restrooms

The information/reception/circulation area of the visitor center will contain an information/reception desk and trip planning graphic (topographic map or model concept) that orients visitors to the national

monument and conservation area. An exhibit will convey safety information and will be placed in a prominent location in the information/reception lobby. It is important that the entrances to public restrooms (accessible from both inside and outside the visitor center) be located so that this function does not add congestion in the information/reception space. Adequate circulation space will be provided for visitors coming and going from the exhibit area. The sales and publication display area will be out of the main circulation area but in view of the information desk personnel. Storage and a small work space for association personnel should be near the sales area.

The core experience for all visitors who stop at the visitor center will be the AV presentation. A 50-seat auditorium will be provided, and the exhibit area will complement the AV presentation by highlighting selected components that comprise El Malpais' cultural landscape.

Space will be provided for four NPS offices (one maintenance office and three ranger offices). The

visitor center will also provide a library/workroom space for NPS personnel, NPS storage space and conference room, a first aid room, and a small workroom/storage space for the cooperating association.

A small view deck with informal seating adjoining the building will serve as an area for visitors to relax in the out-of-doors before continuing their trip. This view deck will also serve as a trailhead for an interpretive trail that will take visitors to the edge of a lava flow and another trail that will lead to the top of Sandstone Ridge.

The functional relationships in public use spaces will be as follows:

## Size

Information/reception/circulation	1,500 sq ft
Cooperative association sales and display	300 sq ft
Cooperative association storage/workspace	300 sq ft
Public restrooms	600 sq ft
Auditorium (100 seats)	1,000 sq ft
Exhibit area/video alcove space	1,500 sq ft
NPS office space (4 offices)	600 sq ft
Library/workroom	400 sq ft
Storage	400 sq ft
NPS restroom	200 sq ft
Conference room	200 sq ft
First aid room	50 sq ft
Mechanical	500 sq ft
	<b>7,550 sq ft</b>

## Details of Interpretation

**Audiovisual.** The visitor center AV presentation will convey a distinctive mood and the message that El Malpais is a special place. This AV will be more than a geology story with a little human history thrown in. This rugged landscape will be portrayed in the “world view” where land and culture are one. The AV should invoke a feeling and attachment to both the landscape and the American Indian people who have occupied it over the past 1,000 years. This story will focus on El Malpais as a cultural landscape and will encourage the audience to “read” and appreciate this landscape and its creation, as well as the cultures that have been and are today inextricably part of its evolution. Religious activities, directional and geographic symbolism, legends, and storytelling (tribal assistance and review required) are all possible vehicles to portray

portions of this story. The program will provide the audience a window into the world view of other cultures with the purpose of presenting the relationship between American Indian people and the land. If successful, subtle intangibles might pervade beyond this experience to encourage us all to look at things in a different way – with a deeper and continuing respect for all humans in our surroundings.

**Exhibits.** One portion of the exhibit area would emphasize the evolution of landforms. The El Malpais lava flows are among the most significant volcanic areas in the United States.

One exhibit will use techniques to give scale and dimension to this volcanic landscape, allowing the visitor to grasp the boundaries, expanse, and contrasts (sandstone formations vs. lava flows) of this unusual area. The Sandstone Bluffs site on NM 117 may be highlighted as the best location for a dramatic panorama of El Malpais.

Video units can be used to demonstrate the formation of the different types of lava surface features, lava tubes, and lava tube systems. For example, lava features at El Malpais may be shown, and then the same type of active features at Hawaii Volcanoes National Park may be spliced in to provide contrast (as is done at Lava Beds National Monument).

An exhibit/video technique will also show the sequence of individual flows at El Malpais, cross-referencing the time period of these flows with other regional, national, or international events in time.

Another exhibit will graphically identify and locate these different volcanic features and encourage personal discovery of these and other features.

Some of the most interesting ecological adaptations that plants and animals have made to survive in this harsh environment will be presented in an exhibit. Certain areas host enclaves of wildlife and plants especially adapted to conditions in El Malpais, including some species not commonly seen in the region. Briefly, the collage of topics may include the following:

**Bats** -Although visitors will not go into Bat Cave, they will be told about the bat flights at El Calderon. A few basic facts about their life cycle as it pertains to El Malpais will be provided.

**Kipukas** – Because these features are in more remote areas of the lava flows and are not easily accessible, most visitors may never see a kipuka. An exhibit will depict kipukas as islands in the middle of a sea of lava, showing them as elevated areas of older land surrounded by lava. A brief description of how kipukas are formed and the unusual habitats found within them may be discussed.

**Inverted Life Zones** – Visitors expect aspen trees growing in higher elevations where abundant moisture is available; they may be surprised to find aspens growing in this seemingly dry, barren lava landscape at elevations where they seem out of place. This exhibit will highlight this inverted life zone relationship, explaining why aspen grow at low elevations on or near the base of the lava with pinyon/juniper (species usually associated with desert-like habitats).

**Diversity** – Although the vegetation in El Malpais has been divided into three common vegetation communities – Douglas fir/ponderosa pine, pinyon/juniper, and Apacheplume – it should be noted that a wide variety of unusual plants and numerous microhabitats occur in this seemingly homogenous environment, hosting a number of faunal and floral species that would not normally occur in the area.

**Dwarf Forests:** Driving along NM 117, visitors will see the twisted trunks, gnarled bark, and the dwarf size of the trees on the lava surface. A brief explanation of this “bonsai” effect is needed.

Another portion of the exhibit area will complement the film by highlighting past and present cultures that have had contact with or have been directly

influenced by the badlands (El Malpais) landscape. American Indian stories tell about the fire-rock and its effect on their lives. No attempt will be made to tell the entire story of any particular culture; however, visitors should grasp that this landscape has been viewed from the perspective of many different peoples. Graphics, artwork, poetry, photographs, appropriate objects, period artifacts, narrative support, and silent video inserts (if applicable) may be used in these exhibits to contrast and compare different cultures. These exhibits will be designed to stand alone and will not be viewed in sequence.

Another exhibit will interpret the post-Chacoan era (A.D. 1300-l 540) up to and including the time of European contact. This exhibit will focus on the late prehistoric period, which witnessed the shift from scattered regional settlements characteristic of the Chaco era (A.D. 900-l 150) to large aggregated communities more like modern-day pueblos. This aggregate settlement period had its own distinctive regional art style, and artifacts will be used to further contrast this cultural transition. The exhibit may highlight the year 1540, which marked the end of the prehistoric period in the Southwest. (Spanish exploration and settlement and the introduction of European diseases, new crops, and domestic animals forever changed traditional American Indian patterns of adaptation.)

An exhibit will interpret those contemporary American Indian cultures that have direct ties to El Malpais. Because some of the large prehistoric communities are recognized as ancestral villages by modern Pueblo people, this exhibit will complete the cultural continuum initiated by the Chaco era exhibit. Working closely with the various tribes, the appropriate exhibit materials, artifacts, and scripts will portray the importance of El Malpais from the perspective of the Acoma, Zuni, Laguna, and Navajo. This exhibit will be designed to stand alone; however, a small associated demonstration area can be used at appropriate times to allow visitors to learn firsthand about the customs, crafts, literature, poetry, and perspectives of the native inhabitants.

Publications will be provided to interpret selected historical and contemporary happenings – a calendar of events that has some tie to El Malpais. Theme treatments will be brief and read like newspaper headlines, with pictures and minimum narrative. Visitors will be intrigued by the procession of history that has passed within view of

these badlands. There will be information about specific publications for in-depth treatment of any particular subject. Topics may include the following:

#### **Exploration –**

- Coronado's expedition to the Seven Cities of Cibola skirted segments of El Malpais. (1540)
- The Dominguez-Escalante expedition (seeking a route to link New Mexico with the northern empire of California) camped at McCartys. (1776)

#### **Western Expansion –**

- The Whipple expedition (to find suitable transcontinental railroad routes) described El Malpais firsthand as a "whole length of valley...threaded by a sinuous stream of lava." (1853)
- The Beale expedition (to locate a wagon route to the Pacific) described El Malpais as a crossing of "many streams of lava, which appear to have rolled in a fiery torrent just as a mountain stream from the hills." (1857)

#### **Settlement, Economic Diversity, and Expansion –**

- Homesteading and the coming of the railroad brought the first hint of "civilization" to El Malpais, permitting the Anglo culture to gain an economic foothold that attracted a slow but steady increase in population. With this new economic era came some of that old wild West charm, with railroad workers, ranchers, cowboys, Basque sheepherders, sodbusters, gold seekers, and lumberjacks. This melting pot of characters all thrived in El Malpais area during the late 1800s and early 1900s.

#### **El Malpais in the Twentieth Century –**

- The 20th century brought little stability to the economy of the area. Various agricultural endeavors and mining for fluorspar, pumice, and uranium brought only temporary relief from a cycle of economic recessions. In 1942 El Malpais was used as a bombing range. Today, with the establishment of the monument/conservation area, local

residents hope that tourism will improve the regional economy.

**View Deck/Trailhead.** A wayside exhibit on the interpretive trail from the view deck may identify the flow as "aa" and explain its formation and source. One panel may explain the abundance and variety of the vegetation (ecotone) that grows along the lava edge because of the higher concentrations of moisture. A connecting short loop trail near a portion of the lava flow will give visitors a chance to see a lava flow first hand.

This view deck will also serve as a trailhead for access to Sandstone Ridge. Visitors will travel a strenuous trail to the top and be rewarded with panoramic views of the **Bandera Crater** area, commanding views of lava in the foreground, and distant views of the other volcanic terrain. Wayside exhibit panel(s) will identify major geographic points of interest with specific attention to features that may have special value to American Indians. From the overlook, visitors may take a trail down the west side of Sandstone Ridge to the **Bandera Crater/Ice Cave** trailhead.

## APPENDIX G: NOMINAL GROUP WORKSHOPS ON EL MALPAIS MULTIAGENCY VISITOR CENTER

Two planning workshops, using the nominal group process, were conducted to assist in developing objectives for the multiagency visitor center. Participants in the first, conducted in Albuquerque on October 19, 1988, were the El Malpais planning teams from the National Park Service and the Bureau of Land Management, with additional representatives from the Acoma Tribe and the NPS regional office in Santa Fe. The second was conducted in Grants, New Mexico, on December 12, 1988, and included representatives from the Bureau of Land Management, the National Park Service (El Malpais and El Morro), the State of New Mexico (Tourism Office and Energy, Minerals, and Natural Resources Department), Grants Chamber of Commerce, City Manager of Grants, Cibola Convention and Visitor Bureau, and the U.S. Forest Service.

The question used at both workshops was "What objectives should be met (services provided) at the proposed multiagency visitor center?"

In both workshops the participants were divided into two groups. Each produced a separate set of recommendations to consider. Summaries of all four groups follow this discussion. No formal group effort was undertaken to merge the results of the four groups, but the 26 final items (seven each from three of the groups and five from the fourth) fall easily into the following generic categories despite the differing wording and emphases developed by each group.

To encourage visitation, appreciation, and protection of the resources of El Malpais National Monument and National Conservation Area.

To function as a travel and tourism, information, and orientation center - not as a destination in itself. The center could serve three geographic zones: El Malpais monument and conservation area, western New Mexico (a radius of approximately 75 miles from Grants), and the Masau Trail.

To help develop an understanding of and respect for the lifeways, beliefs, and

viewpoints of the American Indian groups in the area.

To provide a cooperative opportunity for federal, state, and local agencies to inform the public about the different agencies involved in resource protection in the region and the services and opportunities each provide.

The few items that do not fit into these categories involved suggestions for the design of the facility or the development of interpretive media.

### GROUP ONE (ALBUQUERQUE)

Group one generated an initial list of 50 items for consideration. The list was reduced to 43 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing item numbers in the following list were those eliminated by the above process.

1. Building shape should be designed with input from local Indian groups.
2. Maintenance area for just building and utilities.
3. Outdoor space adequate for demonstrations, benches for relaxation.
4. Restrooms - outside access - locked at night; orientation map adjacent.
5. Excite visitors to see El Malpais and go there.
6. Travel information center, road safety and conditions.
7. Serve to orient visitors to recreational opportunities in El Malpais and western New Mexico.
8. Regional orientation (including Masau Trail) should be secondary function.
10. A combination interpretive break room/project room for center employees only.
11. Focus of wayfinding threefold – El Malpais, western New Mexico region (including others (USFS, state, etc.) who won't be part of Masau trail, and the Masau Trail.
12. Sales area, a cooperating association.
13. Quick idea where to get needs met in Grants.
14. Provide "platform" for each agency to spell out their role.
15. Provide for American Indian presence.

16. Administrative offices kept to absolute minimum.
17. Information on cultural fabric (diversity of American Indian groups) of the region.
18. Large map with Masau Trail "you are here," and tie into El Malpais as part of trip planning/orientation function.
19. Sales item/storage area for sales and free items.
20. Exhibits for Bureau of Land Management to talk about BLM special areas as a way of illustrating multiple use.
21. Audiovisual area/room.
22. Make clear what is at Sky City and Zuni-Cibola and how to get there. More prominent than secondary themes.
23. Exhibits for folktale- stories of El Malpais.
25. Avoid duplication of services and opportunities available elsewhere in the region.
26. Develop one short AV presentation to present El Malpais overview that will entice visitors to see El Malpais (cover the five interpretive objectives).
27. Present theme of respect for the land (NPS, BLM, USFS, American Indians).
29. Design to eliminate administrative functions from intruding on visitor use area.
31. Downplay agency identification and messages in the building and media.
32. Outline summary of policies and protection of restricted areas.
33. Provide facility to handle special talks to large groups, i.e. schools, clubs, etc.
34. Building and exhibits to be fully handicap accessible.
35. Sales area to provide museum quality items
36. Agency outreach should be subordinate to the dominant themes.
39. Make clear the offerings along 117 and 53 and how to divide time between the two.
40. Downplay agency roles.
41. Passive tie to volcanism in the design of the building.
42. Bas-relief map of the immediate region.
43. Coordinate exhibit spaces.
44. Second function, encourage people to change travel plans and stay in western New Mexico.
45. Maximum visitor stay (in the visitor center) should not exceed 45 minutes.
47. Attractive advertisement for brochures, signs, etc.
48. Encourage development of a single brochure on commercial offerings.
49. Interior layout and design accomplished by one architect.

50. Develop logo for El Malpais, and name building – avoiding obscure labels (good public relations and design).

Each group participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows

Item	Ranking Points	Total
1.	1 4	(5)
2.	3	(3)
3.	1 4 3	(8)
4.	0	
5.	5 4 5 5 5 5 5	(34)
6.	2	(2)
7.	1	(1)
8.	5 4 1 1	(11)
10.	0	
11.	5	(5)
12.	0	
13.	0	
14.	2	(2)
15.	2 4 3	(9)
16.	1 1 1 1	(4)
17.	3 3 2 1	(9)
18.	0	
19.	0	
20.	0	
21.	0	
22.	4	(4)
23.	0	
25.	2	(2)
26.	4 5 2 2	(13)
27.	3 3 1 5	(12)
29.	3	(3)
31.	3	(3)
32.	0	
33.	0	
34.	0	
35.	2 4	(6)
36.	2 4	(6)
39.	3 4	(7)
40.	0	
41.	0	
42.	0	
43.	0	
44.	0	
45.	2 2	(4)
47.	0	
48.	0	
49.	0	
50.	3 4 5	(12)

The top seven items in terms of the number of participants selecting the item and the total of the

ranking points were items 5, 8, 15, 17, 26, 27, and 50.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The seven items were ranked as follows.

Item	Scale Points	Total Priority
5.	10 8 10 10 10 10 10 10 10 10 9	(107) 1
8.	8 1 9 5 3 5 6 6 6 7 5	(61) 5
15.	6 7 8 3 7 8 8 8 9 8 6	(80) 3
17.	7 9 8 7 6 6 5 5 8 9 7	(77) 4
26.	5 5 5 1 2 2 7 7 5 7 3	(49) 7
27.	9 10 7 6 9 7 9 9 7 10 7	(90) 2
50.	4 6 4 8 5 9 1 3 4 5 1 0	(59) 6

The seven items in priority order were:

1. To excite visitors to see El Malpais and go there.
2. Present theme of respect for the land (NPS, BLM, USFS, American Indians).
3. Provide for American Indian presence.
4. Information on cultural fabric (diversity of American Indian groups) of the region.
5. Regional orientation should be secondary function (include Masau Trail in secondary).
6. Develop logo for the monument/conservation area and name building, avoiding obscure labels (good public relations and design).
7. Develop one short AV presentation to present El Malpais overview that will entice visitors to see El Malpais (five interpretive objectives).

## GROUP TWO (ALBUQUERQUE)

Group two generated an initial list of 42 items for consideration. The list was reduced to 22 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing item numbers in the following list were those eliminated by the above process.

1. To facilitate resource conservation and protection, including education of visitors.
2. To convey overall themes and perspectives related to the five interpretive objectives identified for El Malpais.
4. Major function as a reception, information, orientation area – not as a destination area – for three levels (El Malpais, region, and Masau Trail).
5. Facilitate public use of area.

6. To provide the public with the knowledge about different agencies involved in its operation.
9. To accommodate special events associated with El Malpais marketing.
10. To arouse peoples' curiosity and engage their feelings as we inform them.
19. Contrasting experiences in space/time. Ties into American Indian world views in design and experiences not just a verbal introduction.
20. To provide public restrooms.
21. To provide complementary, not competitive, services and experiences.
22. To provide use permits.
23. To provide a pleasant and relaxing atmosphere.
24. An imaginative (360-degree orientation) environmentally responsive design both internally and externally.
25. Include ethnobotanical landscaping in design.
27. Interpretive publication sales (Southwest Parks and Monuments Association), not souvenirs; no concession.
28. Provide limited exhibits.
30. To house separate visitor services, administrative, and law enforcement functions.
32. Multiuse entry plaza for demonstrations, presentations, and relaxing.
33. Provide outreach message for involved agencies.
35. To inspire a love for the resource.
36. To facilitate visitor safety.
42. A joint effort with unified results.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows.

Item	Ranking Points	Total
1.	4 4 4	(12)
2.	5 4 5 4 4 4 4 5	(35)
4.	1 5 5 5 5 5 5 5	(36)
5.	4	(4)
6.	2 2 2 1	(7)
9.	0	
10.	4 3 3	(10)
19.	1	(1)
20.	0	
21.	3 3 2 1 3	(12)
22.	0	
23.	3 1	(4)
24.	2 2 3 1	(8)
25.	0	
27.	3 1	(4)
28.	0	

30.	1	(1)
32.	1	(1)
33.	3	(3)
35.	2 2	(4)
36.	1 2	(3)
42.	2 3	(5)

The top seven items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 4, 6, 10, 21, and 24.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The results were as follows.

Item	Scale Points	Total	Priority
1.	8 7 9 9 4 8 6 5 6 5	(67)	3
2.	10 8 10 10 9 9 7 10 10 10	(93)	1
6.	9 10 7 8 10 10 10 9 9 9	(89)	2
10.	7 6 8 8 5 2 3 8 7 6	(42)	7
21.	2 2 5 5 7 4 4 6 5 3	(60)	5
24.	6 5 6 4 8 3 8 7 8 7	(43)	6
		(62)	4

The seven items ranked in priority order were:

1. To convey overall themes and perspectives related to the five interpretive objectives identified for El Malpais monument and conservation area.
2. Major function as a reception, information, orientation area – not as a destination – providing gateway services for three zones (El Malpais, region, Masau Trail)
3. To facilitate resource conservation and protection through educating the visitors.
4. An imaginative environmentally responsive design both externally and internally.
5. To arouse peoples' curiosity and engage their feelings as we inform them.
6. To provide complementary, not competitive, services and experiences.
7. To provide the public with the knowledge about different agencies involved in its operation.

### GROUP THREE (GRANTS)

Group three generated an initial list of 24 items for consideration. The list was reduced to eight items by combining, rewriting, and/or eliminating some of the items during the discussion phase. The missing numbers in the following list were those eliminated by the above process.

1. Role for federal, state, local, American Indian, and private agencies in providing information and/or uniformed staff.
2. Provide information/orientation to western New Mexico's cultural, recreational, natural, and scenic attractions.
3. Provide information on travel necessities, i.e. road, weather, accommodations.
4. Provide a short scenic/nature trail with handicap access at the visitor center to orient visitors to the site.
5. Showcase El Malpais resources with attempt to encourage visitors to stay in the area.
10. Provide visual aids, displays, artifacts, map board, slide programs.
20. Orientation to Masau Trail.
24. No overnight or major administrative facilities provided at the site.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows. (Note: the other three groups selected seven items to carry into the next phase. This group used five because of the small number they started with and the natural break point in the total ranking scores.)

Item	Ranking Points	Total
1.	5 4 1 4	(14)
2.	5 4 3 2	(14)
3.	3 3	(6)
4.	1 5 1	(7)
5.	2 5 2 5	(14)
10.	3 1 3 4 3	(14)
20.	4 2 2 2 5	(15)
24.	1 1	(2)

The top five items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 5, 10, and 20. Each participant was then asked to rank the five selected items on a relative importance scale of 0 (low) to 10 (high). The results were as follows.

Item	Scale Points	Total	Priority
1.	8 9 5 6 6 9	(43)	3
2.	9 10 7 8 9 10	(53)	1
5.	7 6 8 5 7 8	(41)	4
10.	6 8 9 9 8 5	(45)	2
20.	5 7 6 7 10 2	(37)	5

In priority order, the five selected items were:

1. Provide orientation/information to western New Mexico's cultural, recreational, natural, and scenic attractions.
2. Provide visual aids, displays, artifacts, map board, and slide programs (interpretive media).
3. Provide role for federal, state, local, Indian tribes, and private agencies in providing information and/or uniformed staff.
4. Showcase El Malpais resources to encourage visitors to visit the area and stay longer.
5. Provide orientation to the Masau Trail.

## GROUP FOUR (GRANTS)

Group four generated an initial list of 54 items for consideration. The list was reduced to 20 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing numbers in the following list were those eliminated by the above process.

1. Distribution center for printed information (free and sales) on the travel and tourism information and resources of the area.
2. Provide information on the natural history of El Malpais.
3. Provide audiovisual programs.
4. Provide a calendar/display to advertise local events and special interest activities.
5. Interpret local archeology and American Indian lifeways.
6. Provide restrooms and associated convenience facilities for travelers.
7. Interpret resource ethics (past, present, and future) of the area.
9. Provide information on tourist accommodations and emergency services in the Grants/Milan area.
10. Interpret on-site (El Malpais) values.
12. Provide information on regional recreational opportunities.
15. Provide office/administrative space for the on-site staff only.
17. Adequate parking.
21. Provide some local day-use facilities at the visitor center site (picnic tables, hiking trail, amphitheater).
28. Interpret the area's history.
29. Provide a "welcome function" to the area.
33. Spotlight information on the national monument and national conservation area.

41. Tour-bus accessible.
43. Highly visible highway signing.
44. Computer connected with the tourism industry.
51. Develop an art (theme) mural.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows:

Item	Ranking Points	Total
1.	4 5 5	(14)
2.	2 3 1	(6)
3.		(0)
4.		(0)
5.	3 4	(7)
6.	5	(5)
7.	1 2	(3)
9.	1	(1)
10.	1	(1)
12.	4	(4)
15.		(0)
17.		(0)
21.		(0)
28.		(0)
29.	3 4 3 2	(12)
33.	5 2	(7)
41.		(0)
43.		(0)
44.		(0)
51.		(0)

The top seven items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 5, 6, 12, 29, and 33.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The seven items were ranked as follows:

Item	Scale Points	Total	Priority
1.	10 10 10 6	(36)	1
2.	8 8	(16)	4
5.	7 6	(13)	7
6.	8 6	(14)	5 tie
12.	5 9	(14)	5 tie
29.	6 9 7 8	(30)	2
33.	7 5 10	(22)	3

The seven items in priority order were:

1. Distribution center for printed information (free and sales) on travel and tourism information and resources of the area.
2. Provide a "welcome function" to the area.

3. Spotlight information on the national monument and national conservation area.
4. Provide a calendar/display to advertise local events and special interest activities.
5. Provide restrooms and associated convenience facilities for travelers.
5. Provide information/orientation on regional recreational opportunities (tie with preceding).
7. Interpret local archeology and American Indian lifeways.

## APPENDIX H: COMPLIANCE WITH CULTURAL RESOURCES REQUIREMENTS

### Compliance Actions

All proposed actions will comply with section 106 of the 1966 National Historic Preservation Act as amended (16 U.S.C. 470 et seq.), its implementing regulations, and applicable cultural resources legislation through NPS-28, "Guidelines for Cultural Resources Management."

Proposals in this general management plan will affect sites and areas that are on or may be determined eligible for listing in the National Register of Historic Places. To ensure that proposals for these properties comply with provisions of section 106, the Advisory Council on Historic Preservation, and the New Mexico State Historic Preservation Office have been invited to participate in the El Malpais planning process.

Representatives of the New Mexico State Historic Preservation Office (SHPO) and the Advisory Council met with staff from the National Park Service and Bureau of Land Management for briefings on the general management plan alternatives and resources management sections to give them an opportunity to understand the alternatives and to offer their comments and insights on the process.

On-site meetings at El Malpais with representatives of the New Mexico SHPO aided in evaluating the integrity and national register significance of structures and sites in the vicinity of Bandera Crater and of the multiagency center near Grants, New Mexico. Both the New Mexico SHPO and the Advisory Council will also have the opportunity to review and comment on the draft general management plan. This participation satisfies the requirements of section 106 of the National Historic Preservation Act, as amended.

Between April 1988 and February 1989, NPS and BLM planners met several times with the Acoma, Zuni, and Ramah Navajo, and contacted Laguna Pueblo as part of the public involvement process. Discussions centered around American Indian concerns regarding continued access for traditional use of resources, protection of sites, prevention of visitor trespass, and facilities development. These meetings were highly productive, contributing to

increased communication and understanding among all groups concerned.

### Basic Guidance

Basic guidance for management of the monument lies in its enabling legislation, included as appendix A, and from the general regulations that guide NPS operations and management contained in 36 Code of Federal Regulations (CFR). A discussion of the requirements of the enabling legislation is included in the "Requirements, Issues, and Concerns" section.

Relevant laws and regulations pertaining to cultural resources management are itemized in NPS-28, "Cultural Resources Management Guidelines." The NPS *Management Policies* also provide a basic summary of cultural resources management requirements. For purposes of this general management plan, the following items are deemed the most important.

**The National Environmental Policy Act of 1969** (Public Law 91-190, 83 Stat. 852; 42 U.S.C. 4321 et seq.) and its implementing regulations (40 CFR, parts 1500-1508), which direct the federal government to preserve important historic, cultural, and natural aspects of our national heritage.

**The National Historic Preservation Act of 1966 as amended** (Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470; amended by various public laws including 96-515) declared a national policy of historic preservation. Among other provisos, section 106 of this act requires that the Advisory Council on Historic Preservation be afforded an opportunity to comment on any undertaking that affects properties listed on or eligible for the National Register of Historic Places. Section 110 of this act provides that "prior to acquiring, constructing, or leasing buildings for purposes of carrying out agency responsibilities, each Federal agency shall use to the maximum extent feasible, historic properties available to the agency." Amendments to this act in 1980 stressed the responsibility to preserve and

conserve the intangible elements of our cultural heritage such as arts, skills, folklife, and folkways. **Executive Order 11593**, incorporated into NHPA by amendment, provides for federal leadership in preserving the nation's cultural environment and requires agencies to inventory cultural resources on lands under their control or affected by their programs and nominate eligible resources to the National Register.

**Protection of Historic and Cultural Properties (36 CFR 800)** gives the step-by-step procedures to be followed by federal agencies to ensure that undertakings under their control are in compliance with the 1966 National Historic Preservation Act.

Management and protection of archeological resources are more specifically outlined in

**The Antiquities Act of 1906** (Public Law 59-209, 34 Stat. 225; 16 USC. 431 et seq.)

**The Archeological Resources Protection Act of 1979** as amended (Public Law 96-95, 93 Stat. 721, 16 U.S.C. 470 aa-ii) and the implementing regulations (43 CFR 7) provide for sanctions against persons convicted of removal, defacement, and/or sale of cultural resources from federal lands. Recently enacted revisions (Public Law 100-555, 102 Stat. 2778; and Public Law 100-558, 102 Stat. 2983) to this act require that federal land managers establish programs to increase public awareness of the significance of archeological resources located on public lands. The former law also emphasizes the preservation and long-term scientific use of archeological resources, including survey of "lands that are likely to contain the most scientifically valuable archeological resources." These revisions also lower the threshold under which penalties may be assessed and require agencies to have a schedule and plan for survey of cultural resources.

**Special Directive 67-3 "Conservation of Archeological Resources"** deals with the basic dichotomy between the NPS mandate to preserve archeological sites unimpaired for future generations and the necessity to excavate sites to acquire mission-oriented

information or materials (i.e., those needed for scientific information, interpretation, or excavations that are done to rescue data that are threatened by visitor activities, natural causes, or development approved as part of the general management planning process.) This directive also stresses NPS responsibility for proper and timely curation, including provisions for adequate funding as part of projects.

Especially relevant to management of El Malpais are the various laws, rules, regulations, etc. that deal with American Indian relationships. Primary among these are

**The American Indian Religious Freedom Act**, Public Law 95-341 (92 Stat. 469, 42 U.S.C. 1996), which protects and preserves the right of American Indians to pursue traditional religious activities. As a corollary to this act, NPS Management *Policies* outline procedures for dealing with a variety of American Indian issues and require park managers to engage in the identification of and consultation with American Indian groups traditionally associated with park lands and other resources.

Staff Directive 88-I (October 13, 1988) "**Public Access to NPS Cultural Resources Management Bibliography Reports and Confidentiality of Archeological and Ethnographic Resources Information**" provides direction for review and certification of NPS bibliographic materials and outlines the provisions for protection of confidential cultural resources information, noting that federal land managers shall not make available to the public information concerning the characteristics and location of any archeological or ethnographical resources where such information release may risk harm to the resources or sites.

Other guidance is provided by

Special Directive 85-4 "Procedures for the Museum Collections Repository Western Archeological and Conservation Center, Tucson"

Special Directive 80-I "Guidance for Meeting NPS Presentation and Protection Standards for Museum Collections"

"Archeology and Historic Preservation:  
Secretary of Interior's Standards and  
Guidelines" 1983 (48 *Federal* Register 44716)

Management of Museums Act of 1955 (Public  
Law 84-127; 69 Stat. 242; 16 U.S.C. 18f)

## APPENDIX I: CULTURAL RESOURCES INVESTIGATIONS, INVENTORIES, AND SPECIAL STUDIES AND GUIDES NEEDED AT EL MALPAIS

Because El Malpais is a new area, a number of investigations, inventories, and special studies and guides are needed. These include the following:

a resources management plan (action plan) built upon the cultural and natural resources management sections of this general management plan

a cultural landscape study

a research plan

monumentwide cultural resources surveys, including archeological surveys of historic and prehistoric sites':

- . update old site forms and conduct ground-truthing of sites
- determine which rock cairns, stone bridges, and other trail elements, walls, circles, and cists are prehistoric or ethnographic and which are more recent additions by pothunters or monument managers
- . locate, document, and evaluate historic and prehistoric ways and trails across the badlands

archeological overview and assessment<sup>2</sup>

archeological evaluation study

cultural resources base map

a historic resources study

a scope of collections statement

collections management plan

collections storage plan

historic furnishings report (for interpretation of Candelaria cabin)

historic structures reports for the trading post complex and the prehistoric structures at Las Ventanas

an enhanced ethnographic program as defined by NPS-28 (2: 16, 22), which should include the following:

- ethnographic assessment<sup>3</sup>
  - . traditional [resource] use study (ethnobotanical study)
  - . ethnographic oral histories and other anthropological studies of human lifeways
  - . ethnohistory

In addition, data from these various surveys and inventories need to be included in one of several NPS-wide cultural resource inventories:

a list of classified structures, encompassing both historic and prehistoric structures

cultural sites inventory (consisting of prehistoric and historic archeological resources and contemporary ethnographic resources, as appropriate)

national catalog of museum objects, encompassing all cultural and natural history objects in El Malpais collections

1. See the previous comments in "The Plan for Cultural Resources Management" section regarding release of site-specific information.
2. Arthur Ireland's cultural prehistory study (NPS 1988a) is an excellent beginning for an expanded archeological overview/assessment.
3. The Holmes report (BLM 1989) fits most of the NPS-28 criteria for an ethnographic overview/assessment.

## APPENDIX J: CULTURAL RESOURCES RESEARCH AT EL MALPAIS

**Research Rationale.** The enabling legislation, the Archeological Resources Protection Act, and NPS policies and guidelines provide for basic and applied scientific research to support management of cultural resources. NPS-28 also describes research documents and procedures, provides technical guidance, and sets standards for research projects of all types. Research is needed to identify and evaluate important resources and develop adequate management strategies.

Resources preserved in the nation's national parks and monuments form an immense and significant research pool for scientists from many disciplines. Data gained from research in El Malpais can benefit not only the monument, the conservation area, and surrounding areas, but has far broader implications to science on a national and global scale. NPS Management *Policies* provide for NPS support and assistance to researchers doing cooperative and independent research relevant to NPS needs. Appendix 13 to NPS-53, "Special Park Use," outlines procedures for archeological research in NPS areas by qualified individuals, museums, and scientific and educational institutions.<sup>4</sup>

**Types of Research.** Several types of cultural resource research are needed at El Malpais. The first, compliance-related research, deals with the inventory, documentation, and evaluation of resources prior to development or visitor activities that will affect these resources. However, the location, scale, and type of development or use may restrict the scientific inquiry, and research may be limited to the minimum necessary to evaluate significance of a specific site or structure or to recover limited scientific data. Second, effective long-range resource management will also depend on research to identify, document, and evaluate cultural resources, establishing a comprehensive data base for El Malpais.

The last type of research, broad-based scientific inquiry, may also be done in concert with specific development, compliance, or inventory activities,

but more often it is of a thematic nature and focused upon specific, relevant research questions.

**Development of a Research Plan.** A research plan will be developed for El Malpais to generate and express the rationale behind proposed future research, including compliance activities, thematic scientific inquiry, and creation of a comprehensive cultural resources data base. The plan will define the scope, priorities, and research strategies that will be employed at El Malpais. It will also structure and guide the various activities performed during the cultural resources inventory and evaluation process, link all these activities to defined goals, and outline realistic expectations and feasible schedules.

The research plan will also integrate resource inventories and evaluations from different disciplines. It will be the vehicle to unite the various small compliance-related projects to better overall understanding of the entire monument research program; prevent cumulative impacts to sites; guide future specific research designs; and serve as an efficient and comprehensive tool to help comply with section 106 of the National Historic Preservation Act.

The plan will incorporate results of other research in the region when developing project proposals. The El Malpais research plan will be coordinated with BLM research efforts and recognize direction set by the New Mexico State Historic Preservation Office as outlined in two publications: *Prehistoric New Mexico: Background for Survey* (Stuart and Gauthier 1981), and the *Comprehensive Plan for New Mexico's Statewide Architectural Survey* (Hicks et al. 1985). The "Secretary of the interior's Standards and Guidelines for Archeology and Historic Preservation" (48 *Federal Register* 44716) and NPS-28 provide direction for identifying, documenting, and evaluating cultural resources, and for planning historic preservation in general.

Research topics relevant to the management of El Malpais may include such things as further

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4. Nondestructive archeological investigations, including use of existing collections, would be more appropriate than large-scale excavation.

examination of Las Ventanas as part of the Chacoan system; relationships between volcanic eruptions and human land use patterns, including dating of lava flows; integration of archeological data to illuminate prehistoric environmental, manipulation and specialized adaptations; definitions of special relationships among lava features and traditional uses; development of reliable cultural chronologies applicable to the El Malpais region; examination of changes in area cultures following the collapse of the Chacoan system; and determination of profiles of past environmental conditions.

## APPENDIX K: DESCRIPTION OF WORK TO BE PERFORMED BY ADDITIONAL STAFF: PREFERRED ALTERNATIVE

### Division of Management and Administration

Purchasing Agent  
GS-07 FTE 1.0

This position will be needed to prepare and process purchasing documents. An extraordinary level of purchasing and contracting will be necessary as this new area is being developed.

### Division of Visitor Services and Resource Management

Resource Management Specialist  
(Fire/Vegetation)  
GS-07 FTE 1.0

This position will be needed to continue inventory and analysis of the area's natural and cultural resources, including establishment and monitoring of vegetation transects within the monument.

Park Ranger (Interpretation)  
GS-07 FTE 1.0

This position will be needed to develop and implement interpretive programs for the east district, including the activities of the multiagency visitor center. Interpretive activities will require extensive coordination with Indian groups of the area.

Park Ranger (General)  
GS-05 FTE 3.0

These positions will be necessary to provide essential visitor services at the visitor centers. They will provide frontcountry patrol in the areas around **Bandera** Crater, the loop road, and the multiagency center.

Park Rangers (Seasonal)  
GS-04 FTE 0.5

These positions will be required to provide a full range of visitor services (such as interpretation, protection, and backcountry patrol). These positions are necessary to provide for a full-week operation with expanded hours during the months of higher visitation.

Park Ranger (Seasonal)  
GS-03 FTE 0.8

At least one seasonal will have extensive knowledge of the American Indians' perspectives of El Malpais. This individual will provide staff and visitors with an expanded awareness of American Indian issues.

Dispatcher/Clerk  
GS-04 FTE 1.0

This position will maintain radio operation at headquarters to monitor routine and emergency communications with the field. This individual will also provide routine preparation of reports, time cards, and correspondence for the division.

## Division of Maintenance

Maintenance Mechanic  
(Buildings & Utilities)  
WG-09 FTE 1 .0

This position will be needed to maintain the facilities and infrastructure at the multiagency center and the Bandera visitor center. The employee will also service buildings and utilities at the employee housing complex.

Maintenance Worker  
WG-05 FTE 1 .0

This position will be necessary to perform inspection and general maintenance of facilities at East Rendija, El Calderon, the Bandera Crater area, and the west half of the Zuni-Acoma Trail. The individual will also perform campground and trail maintenance in the west district.

## APPENDIX L: ESTIMATED CLASS "C" CONSTRUCTION COSTS

### PREFERRED ALTERNATIVE

Description	Gross Costs (in thousands)
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#### Multiagency Center

New orientation center	\$2,184
Paved parking	89
Paved entrance road	234
Telephone/electric	61
Sewer/water	546
Trail	32
Intersection improvements	11
Landscaping/site development	214
Signs	<u>8</u>
<b>Subtotal</b>	<b>\$3,379</b>

#### Bandera Crater/Lava Crater Area Buildings

New Visitor Center	\$2,340
Rehabilitate trading post	117
4-bay maintenance building	684
4 single-family residences	624
4-unit seasonal employee apartment building	<b>262</b>

#### Parking

Paved maintenance yard	47
Paved residential parking	16
Paved visitor center parking	97
Trading post parking	99
Paved Dripping Lava Cave parking	<b>30</b>

#### Roads

Paved entrance road	819
Paved tour road	2,184
Paved maintenance/residential road	624
Paved Dripping Lava Cave road	351

#### Trails

Visitor center nature trail	32
Lava surface features trail	56
Ice Cave trail	35
Bandera Crater trail	30
Bandera Crater connector trail	32
Dripping Lava Cave trail	16
Lava Crater trail	17
Sandstone Ridge trail	115
Sandstone Ridge connector trail	45
Trail inside Dripping Lava Cave	20

Spattercone Valley connector trail	36
Cerro <b>Bandera</b> summit trail	42
Cerro <b>Bandera</b> connector trail	49
Spattercone Valley trail	47

#### Utilities

Telephone/electric	211
Water system (well, tank, system)	936
Septic system	<u>133</u>

#### Miscellaneous

Stairs at Ice Cave	47
Handicap <b>viewdeck</b> at Ice Cave	32
Stairs at Dripping Lava Cave	47
Maintenance yard fence	9
View deck at visitor center	23
Intersection improvements	156
Landscaping, site development	537
Signs (road, directional)	31
Remove noncontributing existing structures	31
Other walks and paths	17
Rehabilitate borrow/cinder pits	312
Picnic area	<u>6</u>
<b>Subtotal</b>	<b>11,392</b>

#### East Rendija Area

Gravel, new county road 42 realignment	1,248
Gravel, improve other parts of County Road 42	624
Obliterate and restore 2 miles of County Road 42	78
Gravel spur road to Cerro <b>Bandera</b>	63
Gravel parking at Cerro <b>Bandera</b>	8
Gravel spur road to primitive campground	312
Campground, primitive	72
Vault toilets in campground	32
Gravel parking at lava wall trailhead	8
Loop trail at lava wall	42
Gravel parking at East Rendija	19
Trail to Big Skyline Cave, Four-Window Cave	44
Trail to Caterpillar Collapse, Seven Bridges	22
Vault toilets at trailhead	32
Intersection improvements at NM 53 junction	16
Landscaping, revegetation	16
Signs	3
<b>Subtotal</b>	<b>2,639</b>

<b>Braided Cave</b>		Intersection improvements with NM 117	8
Dirt parking area and gate	6	Landscaping	5
Trail to Braided Cave	32	Signs	<u>24</u>
Revegetation	2	<b>Subtotal</b>	2,353
Signs	2		
<b>Subtotal</b>	42	<b>The Narrows</b>	
<b>El Calderon Area</b>		New paved spur road	58
Gravel existing El Calderon road	468	Paved parking	13
Gravel road Junction Cave		Handicap-accessible trail to overlook	19
to Bat Cave trailhead	283	Loop trail to lava surface features	22
Gravel parking at Bat Cave trailhead	19	Intersection improvements with NM 117	8
Vault toilets at trailhead	32	Landscaping	5
Bat Cave trail	16	Signs	<u>16</u>
Parking lot/Double Sinks/Junction Cave trail	11	<b>Subtotal</b>	141
Gravel parking at Junction Cave	7		
Obliterate, restore El Corral road (3 mi)	119	<b>McCarty's Crater Viewpoint (option #1)</b>	
Obliterate, restore Bat Cave road (1 mi)	39	Paved spur road	117
Intersection improvements at NM 53 junction	16	Paved parking	13
Design viewing area	1	Trail to viewpoint	16
Landscaping	8	Intersection improvements with NM 117	8
Signs	<u>24</u>	Landscaping	5
<b>Subtotal</b>	1,043	Signs	<u>16</u>
		<b>Subtotal</b>	175
<b>Zuni-Acoma Trail</b>			
Pave two existing gravel parking spaces		<b>NM 117 Orientation Kiosk</b>	
for handicapped	3	Pave roadside parking	10
Obliterate, restore two parking spaces	3	Signs	<u>16</u>
Realign, make handicap-accessible trail		<b>Subtotal</b>	26
to viewpoint	3		
<b>Subtotal</b>	9	<b>Summary Subtotals</b>	
<b>Acoma-Zuni Trail (if easement acquired)</b>		Multiagency center	3,379
New paved spur road and parking	105	Bandera Crater/Lava Crater area	11,392
Intersection improvements	8	East Rendija area	2,639
Landscaping	4	Braided Cave area	42
Signs	9	El Calderon area	1,043
Connecting trail	<u>5</u>	Zuni-Acoma trail	9
<b>Subtotal</b>	131	Acoma-Zuni Trail	131
		Sandstone Bluffs/Las Ventanas	2,353
<b>Sandstone Bluffs/Las Ventanas</b>		The Narrows	141
Realign and pave road to		McCarty's Crater viewpoint	175
Sandstone Bluffs	1,989	NM 117 orientation kiosk	<u>26</u>
Pave new Las Ventanas spur road	117	<b>TOTAL</b>	<b>\$21,330 *</b>
Pave parking at Sandstone Bluffs	52		
Pave parking at Las Ventanas	13		
Obliterate, revegetate 10 parking spaces			
at Sandstone Bluffs	16		
Trail to Las Ventanas	52		
Trail, handicap-accessible at			
Sandstone Bluffs	14		
Handicap-accessible vault toilet	47		
Overlook deck	13		
Lockable entrance gate	3		

\* Does not include Harpers Ferry Center costs for interpretive media in visitor center or for wayside exhibits

**MINIMUM REQUIREMENTS ALTERNATIVE****Multiagency Center**

New orientation center	2,184
Paved parking	89
Paved entrance road	234
Telephone/electric	61
Sewer/water	546
Trail	32
Intersection improvements	11
Landscaping/site development	214
Signs	8
<b>Subtotal</b>	<b>3,379</b>

**Bandera Visitor Center**

Realigned and paved entrance road	936
New visitor center	2,340
Rehabilitate trading post	117
Paved parking	122
Telephone/electric	121
Septic system	67
Water system	500
Remove noncontributing structures	31
Intersection improvements	156
Obliterate, restore road	40
Paved maintenance road	624
4-bay maintenance building	684
Paved maintenance yard parking	47
Maintenance yard fence	9
4 single-family residences	624
4-unit seasonal employee apartment	262
Paved residential parking	16
Ice Cave trail	35
Stairs at Ice Cave	47
Handicap viewdeck at Ice Cave	32
<b>Bandera Crater trail</b>	<b>30</b>
<b>Bandera Crater connector trail</b>	<b>32</b>
Trail to Dripping Lava Cave	6
Lava surface features trail	56
Other walks and paths	17
Rehabilitate borrow/cinder pits	312
Landscaping/site development	400
Signs	2 5
<b>Subtotal</b>	<b>7,688</b>

**El Calderon**

Designate bat viewing area	<u>1</u>
<b>Subtotal</b>	<b>1</b>

**Braided Cave (no new development)****East Rendija (no new development)****Zuni-Acoma Trail (no new development)****Acoma-Zuni Trail (if easement acquired)**

Paved spur road and parking	105
Intersection improvements	8
Landscaping	4
Signs	5
Connecting trail	<u>5</u>
<b>Subtotal</b>	<b>131</b>

**Sandstone Bluffs/Las Ventanas**

Realign existing gravel road	40
Redesign parking	19
Handicap-accessible trail to overlook	14
Overlook deck	13
Lockable entrance gate	<u>3</u>
<b>Subtotal</b>	<b>89</b>

**NM 117 Orientation Kiosk**

Paved roadside parking	10
Signs	<u>16</u>
<b>Subtotal</b>	<b>26</b>

**TOTAL 11,314**

## APPENDIX M: PRINCIPAL LAVA FEATURES IN THE NATIONAL MONUMENT

Following are definitions of the more common surface and subsurface features in the lava flows of El Malpais National Monument, particularly the features present on the youngest **Bandera** and **McCartys** flows that are the least weathered and most easily interpreted to the public.

At El Malpais there are three structural/textural varieties of lava surfaces. These are common around the world in volcanic rocks of basaltic composition (the names of the first two types are words of Hawaiian origin):

**pahoehoe** – relatively smooth surface, sometimes almost pavement-like, but usually with undulations, sinuous folds, and densely clustered **ropelike** structures that show how the fluid lava solidified. This type of lava is the easiest to walk on.

**aa** – irregular surface composed of rough broken masses and often jagged spinous pieces of lava that are mostly a foot or less in diameter. Along with many fissures, these features make **aa** lava very difficult to walk on.

**blocky** – extremely irregular surface with large angular rock masses typically exceeding a foot in diameter, and sometimes exceeding 6 feet. Blocky lava is a tortuous “up and down” terrain, exceedingly slow and difficult to traverse.

All three types are common in the **Bandera** flow where they are frequently observed in close proximity. By far, the most common type in the **McCartys** flow is pahoehoe, which makes accessible parts of this flow comparatively easy to traverse, except in areas where there are large sags and pressure ridges.

**Spattercones (hornitos)**, well-represented on the **Bandera** flow, are formed when fluid lava beneath a hardening surface is ejected upward through holes and builds up towerlike structures. These structures are typically composed of small hardened blobs of lava, and they may be semihollow and interlaced with miniature lava flows, holes, and windows; they often have interesting dripping-lava textures.

**Tree molds** form when lava engulfs a tree or log and the wood burns out rapidly, leaving cylindrical holes in the flow surface. Tree molds are known on both the **Bandera** and **McCartys** flows, but are particularly common near **Bandera** Crater where there is a very unusual tree-trunk squeeze-up (Lindsey 1949a).

**Squeeze-ups** form when viscous lava is extruded through an opening in the solidified crust (Nichols 1939,421). Nichols identifies two types common in the **McCartys** flow: bulbous squeeze-ups representing upward extrusion of lava through vents on the flow, resulting in knobby and **bulblike** structures, and linear *squeeze-ups* representing upward extrusion of lava along cracks. (The linear type is frequently in the form of long, wedge-shaped masses up to a few feet high along the centers of widely opened crevices, and they may show vertical grooves and flutes.) Many fragments of *grooved* lava common to the ruptured pahoehoe crusts of the **McCartys** flow are attributed by Nichols (1938, 609) to the squeeze-up phenomenon. Squeeze-ups are present, but not nearly as common, in the pahoehoe surfaces of the **Bandera** flow.

**Pressure ridges** common to the **McCartys** pahoehoe flow, and less common in the **Bandera** flow, are formed when the movement of the flow beneath the surface continues and the more rigid hardened crust above buckles into elongated ridges and splits. The axes of these ridges are oriented either parallel or transverse to the direction of flow.

**Surface sags and sinks** developed in both the **Bandera** and **McCartys** flows in spots where fluid lava drained out from below and the hot, semiplastic crust drooped into the resulting voids. In some places these voids were so large that the entire surface fragmented and fell into collapse depressions. In the **Bandera** flow, several such depressions are truly enormous. Where large subterranean lava tubes or groups of tubes collapsed, parallel-walled collapse structures were formed.

**Lava walls** refer to places along flow edges where the lava was sufficiently viscous to build up to a considerable height – in places 70 feet above the adjacent terrain.

**Kipukas** (a Hawaiian term) are hills to slight swells that were surrounded by lava flows. Thus, kipukas are islands of older terrain within lava flows. They vary from very small to hundreds of acres, and they are found by the dozens in the McCartys, **Bandera**, and older flows. Kipukas commonly have vegetatively rich lava-edge ecotones, and because some have underlying rock other than lava and have been isolated from access by wildlife, livestock, and humans, they may be islands of unusual biologic composition or diversity.

The origin of large and extensive systems of **lava tubes** and the interesting diversity of rock structures and textures related to them, is discussed in the "Affected Environment" section on geology. (Lava tubes are also called lava caves.) However, it is important here to distinguish between the deeper tubes that drained the center of an entire solidifying lava flow and much smaller tubes, termed **surface tubes**, that are common on pahoehoe lava surfaces and are only of local extent. Surface tubes may be a few feet to only inches in diameter, are seldom more than a few dozen feet long, and are often sinuous and break into miniature lava flows of very interesting shape. Surface tubes are very common on the pahoehoe flows in the vicinity of **Bandera Crater**.

**Ice caves** in El Malpais are simply portions of lava tubes near or beneath the groundwater table that are of the requisite configuration and depth to capture winter air and maintain subfreezing conditions through the warmer seasons. Lava rock is a superb natural insulating material, and there are well over a hundred caves and deep crevices in the **Bandera** and other flows that contain year-round ice. Some of these caves contain floors and walls of ice, ice crystals and "blades," icicles, and ice "bats" or stalagmites. Because the entrances to ice caves are cool throughout the warmer growing season, some support concentrations of ferns, mosses, lichen, and algae that would not otherwise be common at this elevation and latitude. It should be noted that prehistoric human use of El Malpais flows is commonly associated with sources of water and ice. Therefore, archeological sites may be dense where ice caves and icewater springs occur in tubes and sinks in the lava.

## APPENDIX N: MORE DETAILED INFORMATION ABOUT **BANDERA** CRATER AND THE **BANDERA** LAVA TUBE SYSTEM

The actual sequence of volcanic events in the development of **Bandera Crater** is complex and not agreed on by geologists. Hatheway and Herring (1970, 308) list several separate events, in summary including the following: extrusion of **aa** flows including local spattercone activity; formation of **Bandera cone** followed by breaching on its southwest side; eruption of thick pahoehoe flows (through the breach) that flowed for miles and produced the **Bandera lava tube systems** (followed by the recession in the throat of the volcano); and eruption of local **aa** flows from fissures in some of the earlier flows.

The **Bandera** lava field, with numerous craters and flows in the national monument, appears to lie at the intersection of two major and deep-seated "lineaments" or long zones of weakness in the earth's crust, which had their origins in ancient pre-Cambrian time. One zone, the **Jemez lineament**, extends from east-central Arizona across New Mexico to Taos – and perhaps beyond to the Clayton Area in northeastern New Mexico. This lineament seems to be the zone along which several of northern New Mexico's famous lava fields originated. The other zone, the **Zuni-Sacramento lineament**, extends from the Texas line north of El Paso northwesterly to the high plateaus of Utah. Reactivation of these two zones in comparatively recent geologic time, including the resultant eruption of volcanoes at their intersection in the northwestern part of the national monument, makes El Malpais an important area for future research.

Hatheway and Herring (1970) note that most tubes are formed entirely under pahoehoe surfaces. In some situations, an open lava channel may develop a crust while the flow continues beneath, creating a circular tube that may remain intact after the fluid lava drains. This results in tubes that are at most a few hundred feet long, but it does not adequately explain the extremely long tube systems characteristic of the **Bandera** field. The explanation favored by Hatheway and Herring is that cylindrical bodies of more fluid lava, narrow but quite long, developed along the axis of the flow. These cylinders may then have ruptured down flow, forming new extensions of the flow front, and as

long as a supply of lava kept draining through these cylinders, they fed the new flow fronts downstream. When the lava supply ceased, the cylinder drained to form an open tube. Other details of tube formation are reserved to technical literature.

The 14-mile section of the **Bandera** flow that **Carlton** explored for lava tubes in 1988 begins at an elevation of about 7,900 feet at **Bandera Crater** and descends to an elevation of about 7,200 feet. The beginning of the system immediately below the crater may be an "volcanic canyon" rather than having been a roofed tube, but within 1 mile of the crater the system begins to assume a discontinuous subterranean character. The tube system is actually much longer than its estimated axial extent of explored distance, some 14 miles, because of several shorter tributaries that join at various angles to the main channel. Also, the lower extremities of the system branches complexly. Less than 20 percent of the system is in the form of caves that are actually enterable. Some sections show surficial evidence of tubes highly indicative of caves beneath, but they cannot be entered for various reasons, including the surface having been overrun by later lava flows. In other sections, the tube alignment is amorphous and shows no surface expression, if indeed it exists at all. Other sections are elongated pits, which are segments of former tubes that collapsed. (Of this phenomena, Hatheway and Herring note that "tube failure began almost immediately after formation and . . . portions of the tubes underwent complete collapse in periods as short as a few weeks" (1970,317). Despite all these discontinuities, the system contains unbroken tubes up to 3,000 feet long and other tubes approaching 7,000 feet that are breached at only a few intervals by short collapse structures. The combination of subterranean passages with open "windows" and larger collapse structures greatly varies the exploration experience along the tube system. These combinations also offer a notable contrast to other such lava tube systems in the national park system.

In addition to what is said about the lava tubes in the main portion of this document, **Carlton** found that nearly all the lava tubes have ceilings developed immediately below classic pahoehoe

flows. Some ceilings sag, some are upraised in bubblelike or domelike structures, and some are incredibly thin and in places have broken through to make “windows” in the ceilings. The lava tubes in the upper 6 miles of the flow have experienced considerable ceiling breakdown (not necessarily “breakthrough”) and are strewn with piles of angular boulders. Although this condition in caves is common in other portions of the **Bandera** system, it is the lower two-thirds of the **Bandera** tube system that exhibit sections of floor with smooth pahoehoe surfaces. It is also in the middle to lower part of the **Bandera** system that long, continuous stretches of tubes with “classic” oval to circular cross sections are found. These are often really tubelike, with smooth, rounded ceilings and walls, and with floors that may be occupied by shallow pahoehoe flows. In some caves, these “floor flows” subsided in the middle, leaving higher “lava trough” structures along the flow margins. Some passages have one or more lava “curbs” on their sides – long ledges that mark falling levels of molten lava. In other cases, the mid parts of the floor flows are raised compared to the margins.

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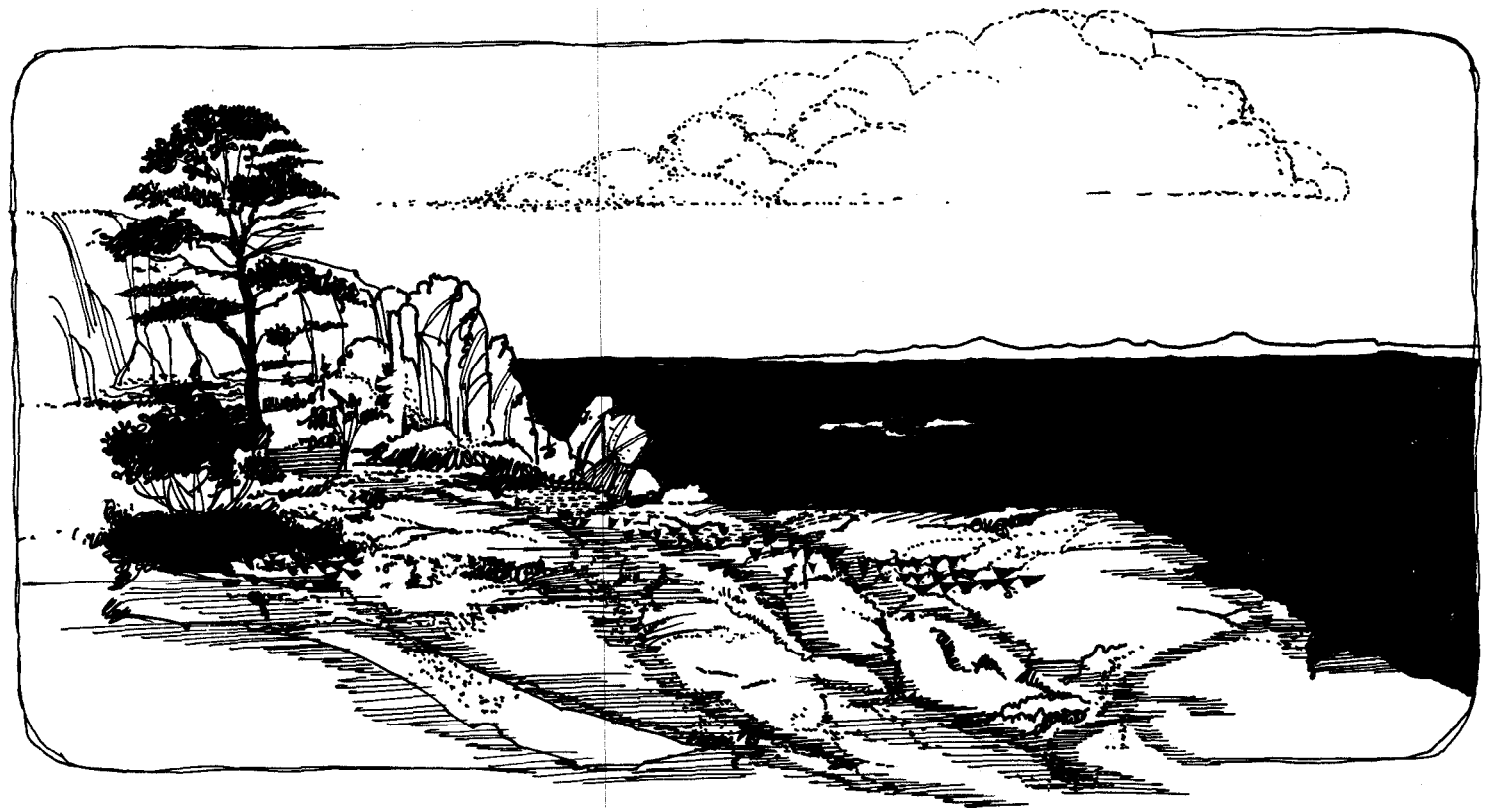
As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our



people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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general management plan  
environmental assessment  
wilderness suitability study



**El Malpais National Monument**  
New Mexico

general management plan/environmental assessment  
wilderness suitability study

---

draft  
january 1990

**EL MALPAIS NATIONAL MONUMENT . NEW MEXICO**

---

**UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE**

## Dear Reader,

Congress established the El Malpais National Monument and National Conservation Area near Grants, New Mexico, with the passage of Public Law 100-225 on December 31, 1987. The national monument contains about 114,000 acres and is managed by the National Park Service. The national conservation area contains about 262,000 acres and is managed by the Bureau of Land Management.

In addition to designating these areas, Congress provided some direction as to how they should be managed and mandated that a general management plan be written for each. Each agency has selected a planning team, and the teams have gathered as much information as possible, consulted with professionals from other government and nongovernment sources and with each other, held public meetings, solicited written and verbal comments, and talked with American Indian groups.

With all this input in mind, each agency has now written a *Draft General Management Plan*, which is ready for review and comment. This document is the draft plan and environmental assessment for the national monument. The plans present the following:

- . The condition of the land and its resources.
- . The proposals for meeting the legislative mandates, enabling visitors to experience the significant features and providing protection for the resources.
- . The feasible alternatives for managing these areas.
- . The impacts of implementing the proposal and the alternatives.

You will find both differences and similarities in the two general management plans. The differences occur because the National Park Service and the Bureau of Land Management have different missions and functions.

The National Park Service promotes and regulates the use of national parks and monuments to conserve the scenery, the natural and historic objects, and the wildlife, and provides for the enjoyment of these things in such a way that future

generations can enjoy them. The general management plan is presented in terms of visitor use areas.

The Bureau of Land Management actively manages public land resources, including those of the national conservation area, to meet the full spectrum of public needs. This management is done in a way that ensures the resources will continue to be available predictably in the future. The Bureau of Land Management's challenge in the national conservation area is to provide for a multitude of uses (such as grazing, home-use woodcutting, recreation, wildlife, wilderness, and cultural values) while preserving the values for which the conservation area was established. The general management plan is described in terms of resource-based management units.

The two plans are similar in that both agencies are concerned with protecting the resources of the El Malpais area, both offer a "preferred" plan and alternative for managing the land under their jurisdiction, and both are committed to responding to American Indian concerns for managing the land. Both plans contain sections on managing cultural resources, natural resources, wilderness, and developing visitor facilities.

Previous public involvement has been the basis for identifying the issues that are addressed in these draft general management plans. These plans, which are submitted for your review and comment, are the next important step in involving the public in the management of these two areas. We now need your written comments and ideas on these draft plans to formulate specific approaches to dealing with the issues previously identified. Public meetings will also be held during the public review period to allow for public comments. Comments on this Park Service *Draft General Management Plan* should be sent to the address below.

National Park Service  
Doug Eury, Superintendent  
El Malpais National Monument  
201 East Roosevelt Avenue  
Grants, New Mexico 87020  
(505) 2854641

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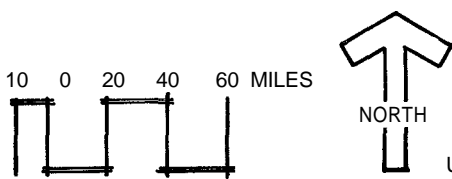
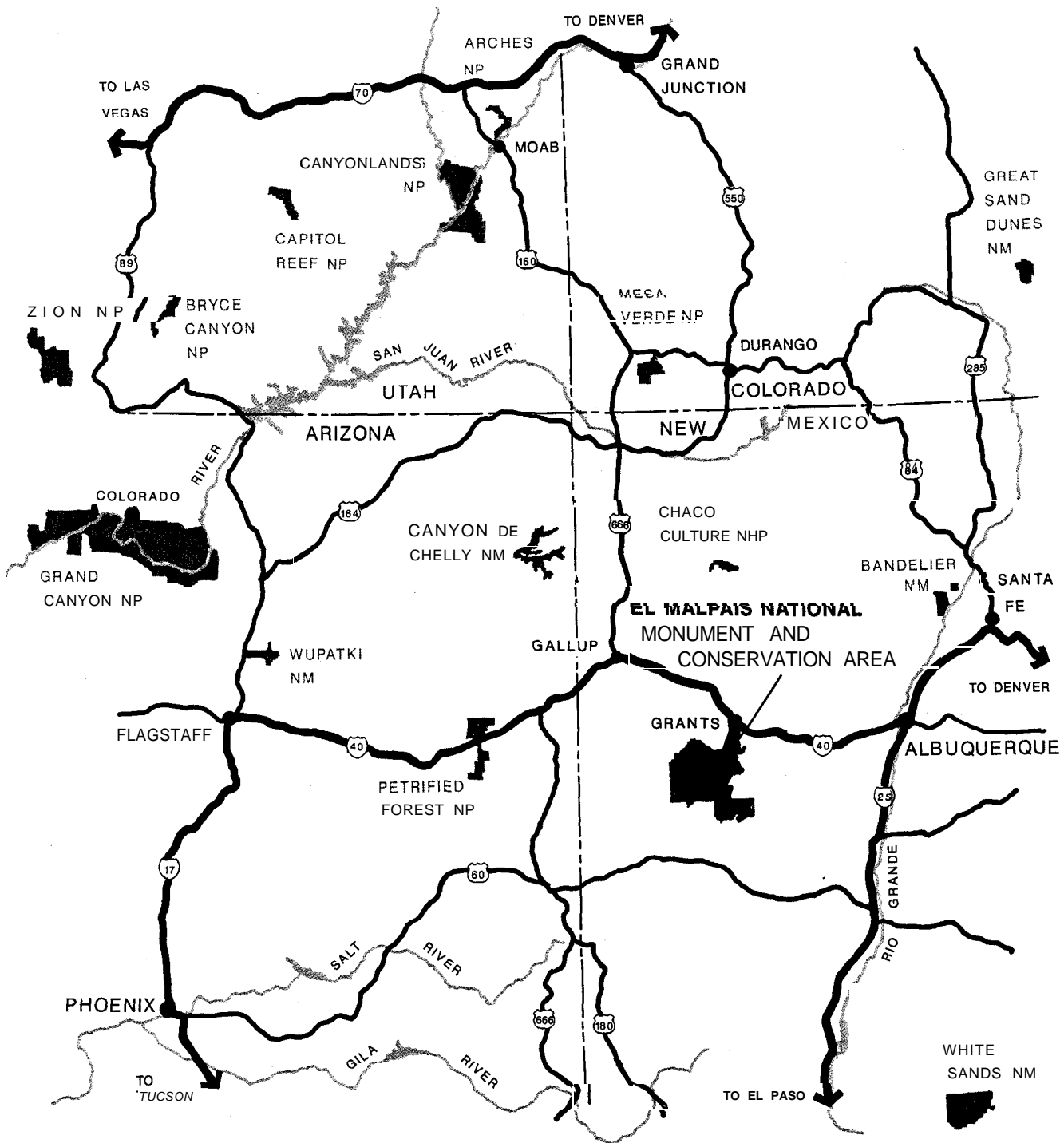
## INTRODUCTION

As of December 31, 1987, El Malpais National Monument is a newly established area of the national park system (see Region map). Most of the monument, about 114,992' acres in northwestern New Mexico, is volcanic terrain and includes some of the most recent lava flows in the continental United States. "El Malpais" means "bad lands." This rugged area contains fragile biotic and cultural resources, the latter comprising a record of human occupation that extends from the distant past to the present and marking occupation by several prehistoric and contemporary Indian cultures. The significance of the cultural and natural resources is only partly known and requires that planning for visitor use be conducted with sensitivity and constraint. The monument has few existing facilities for visitors, and public use, except at a commercial ice cave, has been sparse.

The land in El Malpais National Monument has deep special meaning to the American Indians in the area, especially the **Acoma**, **Laguna**, **Ramah** Navajo, and Zuni tribes. During planning, Indian interests, including religion, were frequently considered; it was quite apparent that El Malpais and the American Indian people who have occupied and used it for millennia are closely intertwined. The planning team has made a concerted effort to understand this and plan in a way that would help visitors understand this special aspect of El Malpais.

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1. Acreage figures are still in the process of being refined; future figures may deviate slightly from the acreages given in this document.



**REGION**  
**EL MALPAIS NATIONAL MONUMENT**  
U.S. DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE  
DSC/JULY 19891103120.003

## PURPOSE OF AND NEED FOR THE PLAN

A general management plan is needed to establish and guide the overall management, development, and use of the monument for approximately the next 15 years. The primary focus is to protect and preserve the natural and cultural environments; to permit biological, geological, and other natural processes to continue with a minimum of human intervention; to provide opportunities for enjoyable visitor experiences as well as an understanding of the significance of monument resources; and to consult with American Indians on matters of access, development, interpretation, and protection of resources. In the general management plan process, legal requirements, constraints, and problems must be taken into account. These requirements, constraints, and major planning issues are described below; the alternative solutions are addressed later in this document.

## REQUIREMENTS, ISSUES, AND CONCERNS

### Meeting Legislative Requirements

100-225 establishing El Malpais National Monument and El Malpais National Conservation Area (see appendix A) directs the National Park Service (NPS) and the Bureau of Land Management (BLM) to complete general management plans for the two areas by September 30, 1991. The legislation identifies several other conditions that must be satisfied in the general management plans. They are as follows:

The purpose of the monument and conservation area is "to preserve, for the benefit and enjoyment of present and future generations, the area in western New Mexico containing the nationally significant Grants Lava Flow, the Las Ventanas Chacoan Archeological Site, and other significant natural and cultural resources." The secretary of the interior, through the director of the National Park Service, shall manage the monument in accord with the provisions of the El Malpais Act, the act of August 25, 1916

(which established the Park Service), and other laws applicable to units of the national park system. Consistent with the 1916 act, the secretary shall administer the monument for the purposes of preserving the scenery and the natural and cultural resources of the monument and providing for public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

Grazing privileges within the monument that are of a fixed term or scheduled for termination before December 31, 1997, are to be continued only temporarily, subject to proper range management; grazing privileges will be discontinued completely on federal lands within the monument on January 1, 1998.

The El Malpais Act authorizes designation of the Masau Trail, a vehicular tour route on existing public roads that links cultural sites in New Mexico and eastern Arizona. El Malpais National Monument is one of seven units linked by the trail, and the secretary of the interior (through the Park Service) is authorized to add other sites of national cultural importance that are protected by federal, state, and local governments, Indian tribes, or nonprofit entities. Informational material is to be distributed along the trail, and the trail will be marked with appropriate markers to guide the public.

### acquisition

other interests by donation, purchase, exchange, or transfer. Specific conditions

federal mineral interests, and the Pueblo of **Acoma** are detailed in the legislation (see appendix A).<sup>2</sup> Under the legislation and

and patent under the mining laws, and granting of mineral and geothermal leases are prohibited.

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2. Acquisition of nonfederal property and interests in the monument will be based on recommendations in the **Land Protection Plan** (NPS 1989b).

Access to the monument and conservation area is ensured to Indian people for traditional cultural and religious purposes, including the harvesting of pine nuts, and such access is to be consistent with the American Indian Religious Freedom Act and the Wilderness Act. Planning will proceed in consultation with the Acoma and other Indian tribes to provide this access and protect traditional sites and values; the secretary may, on request, close areas temporarily to protect religious privacy.

Rights to the minimum amount of water necessary to carry out the purposes of the area are reserved to the federal government. Establishment of the monument does not affect preexisting water rights or applications pending (as of the date of the act) that are subsequently granted; the priority date of such rights is the date of enactment of the El Malpais Act. The Park Service is not required to allow future drilling of water wells within the boundaries of the monument.

Cooperation with other federal, state, and local public departments and agencies, Indian tribes, and nonprofit entities providing for the interpretation of prehistoric and historic civilizations in New Mexico and eastern Arizona is encouraged in order to provide unified and cost-effective interpretation. The secretary is also authorized to cooperate in the development and operation of a multiagency orientation center and programs on lands and interests in lands inside and outside of the boundaries of the monument and conservation area, with concurrence of the owner or administrator.

Funds are authorized for the national monument: \$1 million for development, \$10 million for land acquisition, and \$500,000 for planning and development of the Masau Trail.

In addition, the legislation sets forth requirements for the general management plans for both the monument and the conservation area. These plans will contain at least

visitor services plans, including “a continuing program of interpretation and public education about the resources and values of the monument”

proposals for public facilities, including a visitor center in the vicinity of Bandera Crater and a multiagency orientation center in or near Grants, New Mexico and adjacent to Interstate 40 to accommodate visitors to western New Mexico

natural and cultural resources management plans, “with a particular emphasis on the preservation and long-term scientific use of archeological resources. . . to be prepared in close consultation with the Advisory Council on Historic Preservation, the New Mexico State Historic Preservation Office, and the local Indian people and their traditional cultural and religious authorities”

wildlife resources management plans, prepared “in close consultation with appropriate departments of the State of New Mexico and using previous studies of the area”

a review and recommendation as to suitability or nonsuitability for wilderness of all roadless lands within the boundaries of the monument, except the lands that are designated for development

## Natural Resource Issues

Natural resource studies have been conducted over the years by various agencies and individuals; however, many are dated. A full evaluation of monument resources has not yet been conducted, and additional information/studies are needed on

- threatened and endangered species
- lava tube systems and their fragile biota and rock and mineral formations
- ice deposits and the impacts of human use on these sensitive resources
- the impacts of grazing – including competition between livestock and wildlife for food and water, introduction of exotic vegetation, and degradation of soil, water quality, and aesthetics
- increasing backcountry use
- the incidence of wildfires, fuel-load buildups, and historical fire data
- threats to air quality (baseline data)

In addition, what impacts on soils, vegetation, wildlife, air quality, and visual quality will occur from construction and visitor use in and near developed areas? How will increasing visitation impact resources in backcountry areas, including areas identified as suitable for wilderness? What actions could be taken to mitigate these impacts?

There are scarred areas within the monument (related to past and present mining, timbering, and grazing operations). The main problems related to these practices are soil erosion, proliferation of exotic plant species, disturbance of wildlife habitat, and visual intrusions. Which of the disturbed areas need to be revegetated and how should reclamation be accomplished?

### **Cultural Resource Issues**

Without accurate information about the location, condition, and significance of cultural resources, visitor use or inappropriate siting of developments could damage the resources, resulting in the loss of scientific information and diminishing opportunities for interpretation. Also, without this information managers cannot make fully informed decisions and they cannot effectively monitor and preserve these resources. What programs need to be started and what are their priorities? What historic structures reports and other specialized plans are needed to guide research, adaptive use, and preservation maintenance actions? What sites are significant and should be nominated to the National Register of Historic Places?

What objects/specimens should be in the El Malpais museum collection? How and where will the collection be stored, managed, and protected? (There are currently no collection plans or curatorial storage facilities at the monument.)

What can be done to stop the looting and vandalism that seriously threaten the archeological resources? What staffing, educational programs, and other types of protection are necessary?

### **American Indian Concerns**

As specified in the enabling legislation, how will the mandated American Indian access to El Malpais for traditional uses, including religious and subsistence activities, be provided? How can visitor trespass on

Indian lands be prevented, and how can sacred sites be protected from curiosity seekers, looters, and vandals?

American Indians have expressed concerns that no religious objects be acquired or exhibited by the Park Service and that interpretive programs and media are respectful of American Indian cultures. In what ways can the National Park Service respond to these concerns and how can the Park Service provide interpretive media and information that is acceptable to the American Indians?

How can trust and improved communication between American Indians and federal agencies be promoted? What kind of programs would be acceptable, and what kind of consultation with American Indians would allay their concerns and ensure their input in proper management of monument resources?

### **Visitor Use Issues**

**On-Site Interpretation.** Some visitor assistance is available at the information center in Grants; however, except for a private tourist operation in the **Bandera Crater** area, on-site interpretation in the monument is almost totally absent. What access and facilities are needed so that visitors can enjoy a variety of natural and cultural resources? What messages and media (brochures, wayside exhibits, etc.) should the Park Service provide? Are there areas that may be environmentally unsafe for visitors who are not properly prepared, and if so what kind of warnings are appropriate?

**Cooperation.** The monument and conservation area are contiguous, and the lands of each are administered by two agencies; these lands are also important to various American Indian groups and are contiguous to their lands. What planning needs to take place between the two agencies to avoid duplication and inconsistencies in interpretive services and the selection of features to be interpreted? An interpretive program without consultation with American Indian groups would bypass one of the most important resources of the monument. How can the views of the Indians be incorporated into the interpretive program?

**Multiagency Center/Bandera Visitor Center.** The El Malpais legislation calls for proposals for a multiagency center near Grants and a visitor center

near **Bandera Crater**. What should be the specific functions, themes, and media concepts for each facility and how can duplication of information and efforts be avoided? How will information about the Masau Trail be presented at the multiagency center?

**Recreation.** What kind of recreational activities are compatible with protection of the resources and should be provided in the national monument?

## Access and Development Issues

**Roads.** Except for state highways 53 and 117 (hereafter referred to as NM 117 and NM 53), existing roads in the monument are inadequate to accommodate projected visitation and provide for public safety. Road maintenance, even on existing gravel segments, is expensive. County Route 42, like many of the little-used dirt roads, has irregular curves. Water collects on its sunken surface, leading drivers to circumnavigate impassable mud holes, resulting in environmental damage. Most road alignments within the monument do not consider aesthetics, including views of the landscape. The gravel road to Sandstone Bluffs overlook is the only significant visitor access on the east side of the monument. This road is dusty much of the year, becomes muddy after rain, and includes an unsafe curve.

To provide a safe and enjoyable visitor experience and adequately protect the monument resources, what roads need improvement or realignment? Is additional access to some parts of the monument needed? What should be done to provide all-season access to areas that are determined important for this kind of visitor use? Do any roads need to be closed?

**Facilities.** The temporary El Malpais information center in downtown Grants is the only public facility in the region for NPS and BLM information functions. Because of its small size and location, this facility cannot meet the visitor use needs of the monument once visitation begins to increase. The eastern side of the monument has no facilities for public use other than parking at Sandstone Bluffs overlook. The only developed facilities for day use on the western side of the monument are the privately owned trading post and trails at **Bandera Crater**, and these structures do not meet federal accessibility standards. What type and size of

facilities would accommodate projected visitation and interpretation, staff, and administrative functions?

**Utilities.** Utilities exist only at **Bandera Crater**, and these are inadequate to serve projected visitation. What electrical power and telephone services are needed for visitors and staff, and how can the lines be kept visually unobtrusive? What water and sewage treatment facilities are needed in the monument? How will adequate water be supplied?

**Trails.** There are few trails in the monument; trails in the **Bandera Crater** area do not lead to enough representative resources for monument purposes and do not provide for various levels of skill. What types of trails in what locations would provide appropriate visitor experiences? What improvements do existing trails need? How could the trail system developed for the monument incorporate the future Continental Divide Trail? The cost of developing new high-standard trails over lava compared to the likely volume of use is also an issue.

**Signs.** Signs for orientation and information within the monument are virtually nonexistent. The few existing government signs merely mark the monument and conservation area boundaries on NM 53 and NM 117; most of the monument is also lacking signs that identify access and important regulations. What signs are needed and where? What sign design would be easily comprehended and compatible with the resources and landscape? What coordination can be done between the Park Service and the Bureau of Land Management to ensure harmonious and nonduplicative signs?

**Handicap Access.** Currently there are no special facilities or trail improvements anywhere in the monument to accommodate visitors with mobility, mental, or sensory handicaps. Except for the little that can be seen from inside an automobile, there are no opportunities for handicapped visitors to have firsthand observations of lava caves, lava surface features, or cultural resources. What can be done to make representative areas of the monument available to handicapped individuals?

## Management and Operations Issues

The current level of staffing does not adequately provide for management of the monument and its

resources in a way that protects the environment and complies with legislative requirements. What programs and staffing levels are needed to provide basic visitor services, maintenance activities, and protection, monitoring, and research of the monument's natural and cultural resources?

There is a total absence of offices, maintenance space, and housing for personnel within the monument boundary. Where should offices and housing be located so that personnel can provide effective management of visitor services and resources, respond to emergency situations, and dissuade illegal behavior such as looting, vandalism, and trespass? Where should fire suppression equipment, first-aid supplies, and other materials required for emergencies be stored?

Should the administrative headquarters continue to be in a central location, with nearby commercial and housing opportunities? Is the current administrative space large enough to accommodate increases in the monument staff as visitation grows?

### **Socioeconomic Issues**

New jobs and an increase in tourism because of development at El Malpais would help improve the local economy. How can the national monument best contribute to the local economy without compromising the values for which the monument was established?

### **Issues of Coordination with Other Agencies**

What agencies and other entities should join in planning the multiagency center, and what geographic areas and informational services should be within the scope of the facility?

Along NM 117 there are several features of great importance to El Malpais' natural landscape and the archeological and ethnographic resources (some on BLM-managed land and some on NPS-managed land). The Park Service and the Bureau of Land Management have a mutual interest in developing facilities and programs that offer long-term, integral protection of the resources along NM 117 and in meeting the needs of visitors along the NM 117 corridor. What type of facilities will be required to effectively manage the corridor, where should they be built, and what staffing from

both agencies is required? How will the Bureau of Land Management and the Park Service plan access to and interpretation of these features so that their activities are complementary but not duplicative? What areas should be interpreted and made accessible by viewpoints and trails? What personal services versus self-guided services should be made available to provide visitors a safe and interesting experience for visitors?

What common programs of protecting archeological and ethnographic sites are needed? What mutual coordination with local American Indians is required to meet the requirements of Public Law 100-225 and other laws and regulations?

Although these issues relate most directly to the NM 117 corridor, the problems of how to provide common programs for protecting archeological and ethnographic sites and natural resources are also issues for the entire national conservation area and national monument.

### **RELATIONSHIP TO THE LAND PROTECTION PLAN**

The National Park Service has been charged by Congress with preservation and protection of park resources and with providing for use of park system areas by the visiting public. To this end, land protection plans are prepared to:

Determine what land or interests in land need to be in public ownership, and what means of protection other than acquisition are available to achieve unit purposes as established by Congress.

Inform landowners about NPS intentions for buying or protecting land through other means within the unit.

Help managers identify priorities for making budget requests and allocating available funds to protect land and unit resources.

Find opportunities to help protect the unit by cooperating with state or local governments, landowners, and the private sector.

The Land Protection *Plan* (NPS 1989b) for El Malpais National Monument has been prepared by the NPS Southwest Regional Office separately but

in coordination with this general management plan. Once approved, the Land Protection *Plan* will become an action element of this general management plan. The Land Protection *Plan* was reviewed by the public in May and June, 1989, with public open houses held June 1 and 2.

The El Malpais *Land Protection Plan* serves as a guide for what land or interests in land need to be in federal ownership, what means of protection are available to achieve the purpose of the monument as established by Congress, and what priorities for acquisition are appropriate. Approximately 18,479 acres of land within the authorized boundary of the monument (16 percent of the total monument) is currently not in federal ownership (it is in private, state, and county ownerships). The *Land Protection Plan* proposes that all of this land be acquired by the Park Service in fee. The rationale for this proposal is fourfold.

The natural resources of the monument are nationally significant and most are nonrenewable. Many resources are very fragile and require high levels of management and protection.

The extensive cultural resources found in the monument are also fragile and nonrenewable. They constitute an important and scientifically significant data base, and their integrity must be preserved. This can best be accomplished through fee acquisition.

Much of the monument land is sacred to the American Indians and is important in their traditions. Federal ownership must ensure access to the land for American Indian religious and traditional purposes over the long term. This access will not be guaranteed if the land remains in private ownership.

There are relatively few areas suitable for administrative and visitor facilities because of the fragility of some volcanic features, the abundance of sacred and archeological sites, the religious importance attached to the land itself, and the rough, volcanic terrain. Most of the suitable areas are now in private ownership.

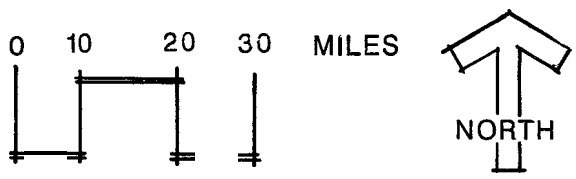
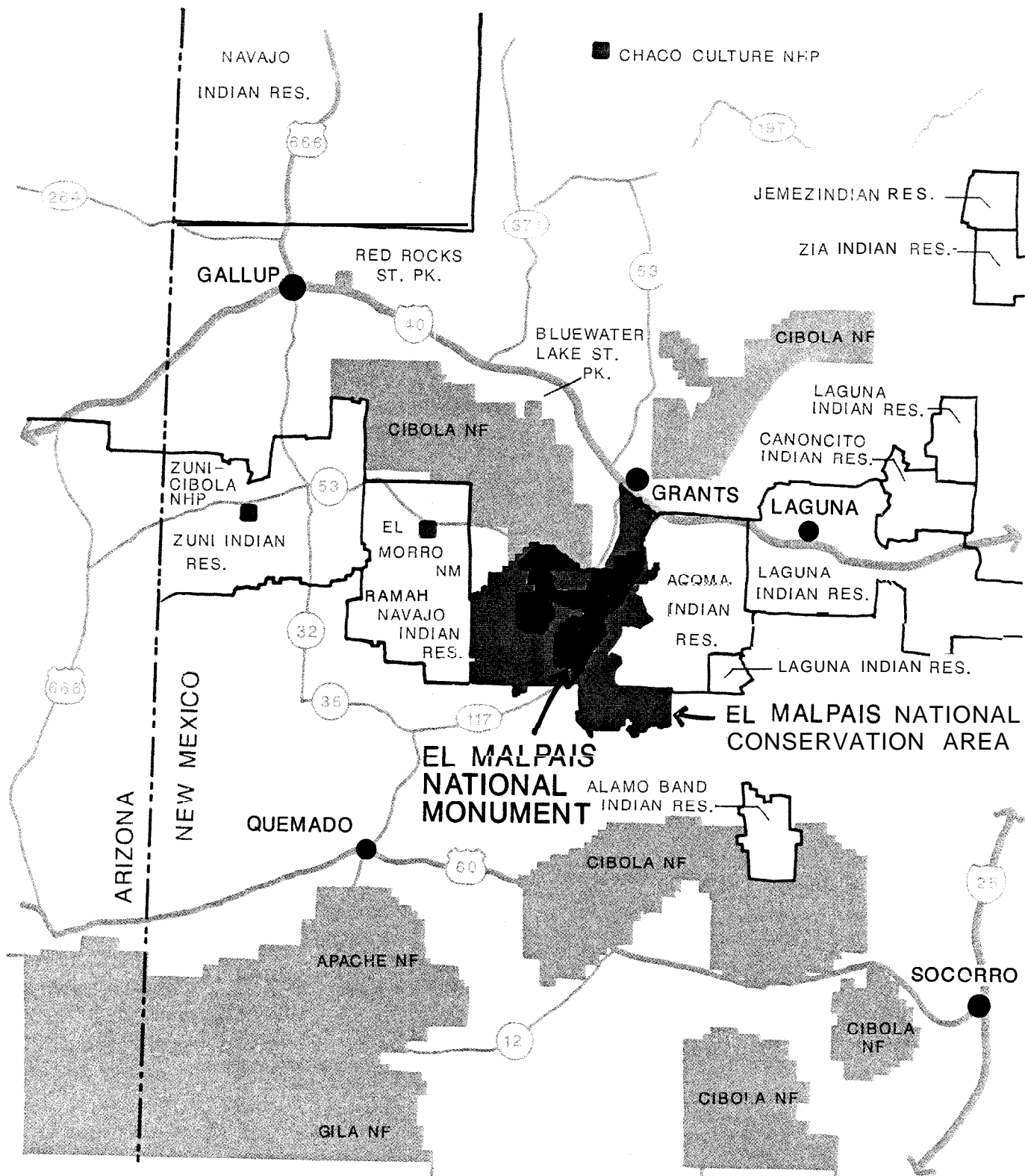
The *Land Protection Plan* identifies a number of issues that can affect the integrity of the monument's resources and the quality of the visitor

experience. These issues include: incompatible uses that are occurring on nonfederal lands within the monument; protecting resources that are integral to the monument (some of which are currently on privately owned land); providing for optimal placement of visitor and management facilities; boundary adjustments; protecting potential wilderness areas for visitor enjoyment and proper land management; and conditions outside of the monument boundaries that can adversely affect monument lands or the visitor experience. These issues and solutions are discussed in detail in the *Land Protection Plan*.

## BRIEF DESCRIPTION OF THE MONUMENT

As the Vicinity and Existing Conditions maps show, El Malpais National Monument/National Conservation Area is in northwestern New Mexico. Grants, New Mexico, on Interstate 40 (I-40), is at the northern edge of the monument. The 114,992-acre monument, entirely within Cibola County, is bounded on the east by NM 117 and on the northwest by NM 53. Most of the national monument is surrounded by El Malpais National Conservation Area. The monument is mostly volcanic terrain and includes some of the most recent lava flows in the continental United States. There are numerous archeological sites and other cultural resources, unusual biological resources, and many ice caves, lava tubes, kipukas, spattercones, lava tree casts, and other interesting volcanic features in the monument. The Existing Conditions map shows some of the placenames and areas discussed throughout the document.

At El Malpais, lava tubes, ice caves, and unusual plant associations, and human culture, history, and prehistory all merge in a rich mosaic. The McCarty flow and other lands are a vast cultural landscape, with traditional importance to several American Indian peoples -the Acoma, Laguna, Ramah Navajo, and Zuni Indian tribes. El Malpais is much more than an economic, scientific, and recreational resource, as recognized in the special provisions of the legislation that authorized the national monument and conservation area.

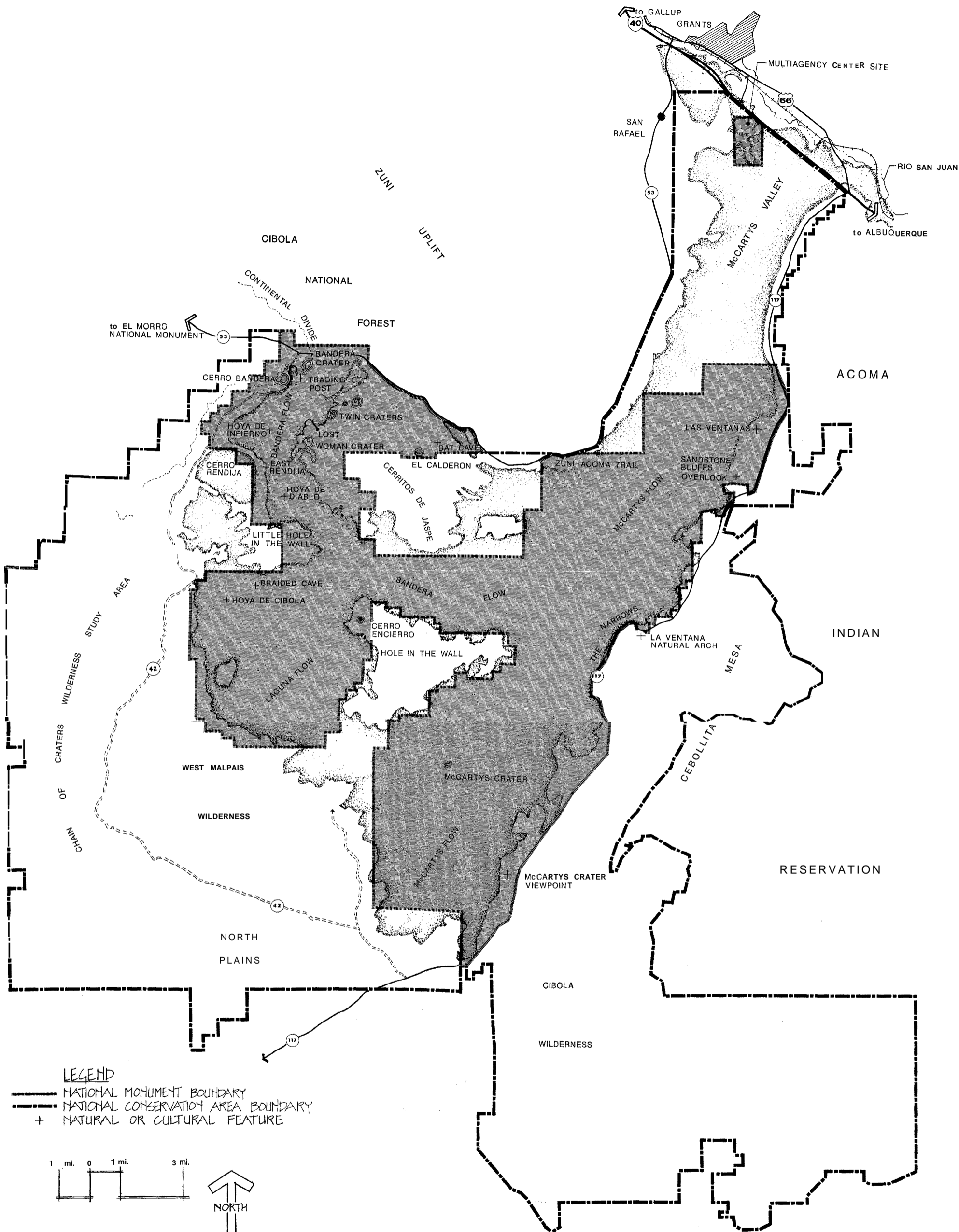


**VICINITY**

**EL MALPAIS NATIONAL MONUMENT**  
**U.S. DEPARTMENT OF THE INTERIOR**  
**NATIONAL PARK SERVICE**

# THE PROPOSED PLAN AND ALTERNATIVES





## EXISTING CONDITIONS

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,005

## BANDERA CRATER VISITOR CENTER

- BUILD NEW HANDICAP-ACCESSIBLE VISITOR CENTER WITH TWO-WAY PAVED ACCESS FROM NM 53; PAVED PARKING
- CONSTRUCT PAVED ONE-WAY TOUR ROAD FROM VISITOR CENTER TO TRADING POST PARKING AREA; CONTINUE ROAD TO NM 53
- CONSTRUCT PAVED ACCESS; PARKING TO ¼ MILE FROM DRIPPING LAVA CAVE; DEVELOP TRAILHEAD; TRAILS TO DRIPPING LAVA CAVE (PROVIDE STAIR ACCESS); LAVA CRATER
- DEVELOP INTERCONNECTING TRAIL SYSTEM TO LAVA FLOW MARCH, SANDSTONE RIDGE, TRADING POST; SPATTERCONE VALLEY. DEVELOP UTILITY SYSTEM FOR VISITOR CENTER, MAINT./RES. AREAS; TRADING POST

## NPS RESIDENCE; MAINTENANCE AREAS

- CONSTRUCT PAVED ACCESS FROM NM 53; PAVED PARKING
- BUILD 4 RESIDENCES; ONE 4-UNIT APARTMENT BUILDING
- BUILD 4-BAY MAINTENANCE BUILDING

## EL CALDERON AREA

- GRAVEL EXISTING ROAD TO JUNCTION CAVE; CONSTRUCT NEW GRAVEL ROAD TO NEW PARKING AREA ¼ MILE FROM BAT CAVE; PROVIDE VAULT TOILETS
- DEVELOP TRAILS TO BAT CAVE; DOUBLE SINKS FROM PARKING AREA; CLOSE EAST SIDE OF BAT CAVE; ALLOW VIEWING
- CLOSE CORRAL ROAD AFTER IMPROVEMENTS MADE ON EL CALDERON ROAD; MARK JUNCTION CAVE TRAIL AND EXTEND TO DOUBLE SINKS; PARKING

## ZUNI-ACOMA TRAIL

- USE; REDESIGN EXISTING PARKING
- MAKE TRAIL TO VIEWPOINT WHEELCHAIR-ACCESSIBLE

## MULTIAGENCY VISITOR CENTER

- CONSTRUCT PAVED ACCESS FROM EAST I-40 INTERCHANGE
- CONSTRUCT HANDICAP-ACCESSIBLE ORIENTATION/INFORMATION CENTER; PAVED PARKING
- DEVELOP SHORT TRAIL

## TRADING POST

- REHABILITATE CONTRIBUTING HISTORIC STRUCTURES FOR ADAPTIVE USE; REMOVE NONCONTRIBUTING STRUCTURES; REDESIGN PARKING
- DEVELOP TRAILS TO SPATTERCONE VALLEY; CERRO BANDERA TRAILHEAD
- PROVIDE PICNIC TABLES (AT LEAST ONE SITE WHEELCHAIR-ACCESSIBLE) NEAR TRADING POST
- MAKE TRAIL TO ICE CAVE; LAVA SURFACE FEATURES WHEELCHAIR-ACCESSIBLE; PROVIDE STAIRS; PLATFORM AT ICE CAVE

## ROUTE 42

- REALIGN FIRST 2 MILES FROM NM 53;
- GRAVEL; ELEVATE ROAD FROM NM 53 TO EAST RENDIJA TRAILHEAD
- CLOSE; REVEGETATE FIRST 2 MILES OF EXISTING ALIGNMENT
- DEVELOP SPUR ROAD, PARKING, TRAILHEAD TRAIL TO SUMMIT OF CERRO BANDERA

## EAST RENDIJA AREA

- PROVIDE 6-SITE PRIMITIVE CAMPGROUND WITH VAULT TOILETS
- FORMALIZE; GRAVEL PARKING; PROVIDE VAULT TOILETS FOR CAVE AREA TRAILHEAD
- DEVELOP TRAILS TO BIG SKYLIGHT; FOUR WINDOWS CAVES
- MARK ROUTES TO SEVEN BRIDGES; CATERPILLAR CELLARIES
- CONSTRUCT GRAVEL ROADSIDE PARKING; LOOP TRAIL NEAR THE LAVA WALL

## BRAIDED CAVE

- GATE EXISTING; ACCESS ROAD; PROVIDE UNIMPROVED DIRT PARKING AREA NEARBY
- MARK ROUTE TO BRAIDED CAVE

## LAS VENTANAS

- CONSTRUCT PAVED SPUR ROAD OFF SANDSTONE BLUFFS ROAD
- DEVELOP TRAILHEAD; TRAIL TO NATURAL ARCH, VIEWPOINTS, ROOM BLOCK, TOWER; GREAT KIVAS
- OPTIONALLY, REMOVE BACKFILL; STABILIZE TOWER KIVA

## RANGER STATION (BLM)

- BUILD STATION, PAVED ACCESS, PARKING, RESIDENCE
- DEVELOP INTERPRETIVE TRAIL

## SANDSTONE BLUFFS

- REALIGN; PAVE EXISTING ROAD
- REDESIGN; PAVE EXISTING PARKING
- PROVIDE WHEELCHAIR-ACCESSIBLE VAULT TOILETS; TRAIL TO OVERLOOK
- INSTALL LOCKABLE GATE FOR OVERNIGHT CLOSURE NEAR NM 117

## ACOMA-ZUNI TRAIL

- CONSTRUCT PAVED ROADSIDE PARKING; TRAIL HEAD (IF EASEMENT ACQUIRED)

## LA VENTANA (BLM)

- CONSTRUCT GRAVEL PARKING AREA; DEVELOP TRAILHEAD; LOOP TRAIL TO ARCH (WHEELCHAIR-ACCESSIBLE SPUR TO VIEWPOINT)
- PROVIDE VAULT TOILETS

## THE NARROWS

- CONSTRUCT PAVED ROADSIDE PARKING
- DEVELOP WHEELCHAIR-ACCESSIBLE TRAIL TO LAVA SURFACE FEATURES
- MARK ADDITIONAL TRAIL TO OTHER FEATURES

## SOUTH BIG NARROWS (BLM)

- REDESIGN; GRAVEL ACCESS; PARKING
- PROVIDE PICNIC AREA
- DEVELOP TRAILHEAD FOR CEBOLLA WILDERNESS

## MCCARTY'S VIEWPOINT

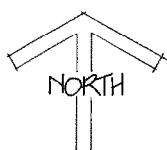
- CONSTRUCT ¼-MI. PAVED SPUR ROAD AND PARKING; DEVELOP TRAILHEAD; TRAIL TO VIEWPOINT; ADD ORIENTATION WAYSIDE (OPTION 1)
- NO DEVELOPMENT (OPTION 2)

## NM 117 ROADSIDE KIOSK (SOUTH)

- IF OPTION 2 SELECTED FOR MCCARTY'S VIEWPOINT:
- DEVELOP PAVED ROADSIDE PARKING
- CONSTRUCT ORIENTATION/INFORMATION KIOSK

## LEGEND

- NATIONAL MONUMENT BOUNDARY (NPS)
- NATIONAL CONSERVATION AREA BOUNDARY (BLM)

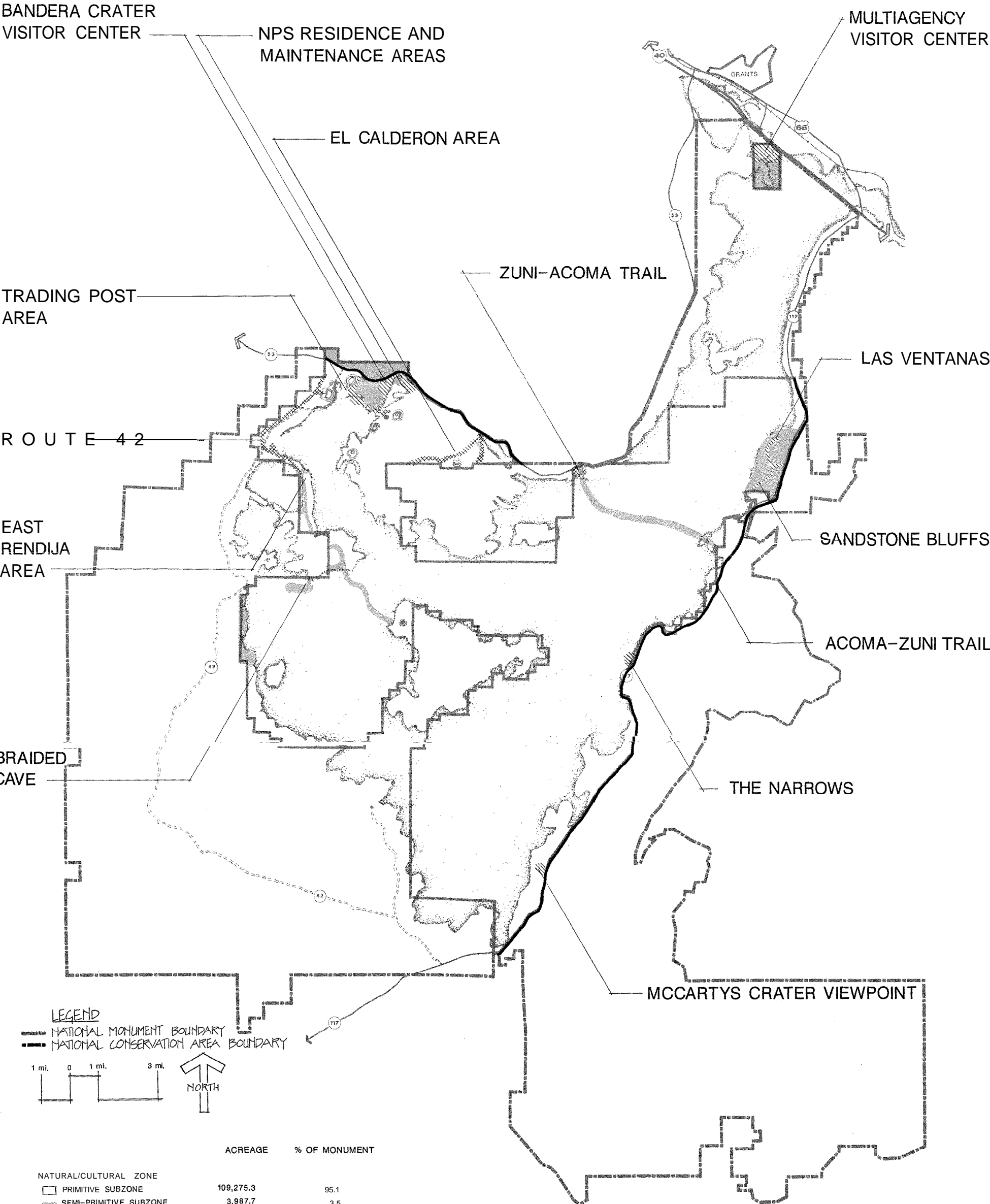


## GENERAL DEVELOPMENT PREFERRED ALTERNATIVE

EL MALPAIS NATIONAL MONUMENT

U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/DEC 1988/10/3/20,007A



	ACREAGE	% OF MONUMENT
NATURAL/CULTURAL ZONE		
PRIMITIVE SUBZONE	109,275.3	95.1
SEMI-PRIMITIVE SUBZONE	3,987.7	3.5
MONUMENT DEVELOPMENT ZONE		
RUSTIC SUBZONE	455.2	0.4
DEVELOPED SUBZONE	804.7	0.7
SPECIAL USE ZONE		
TRANSPORTATION SUBZONE	399.4	0.3
TOTAL	114,922.3	100.0

**MANAGEMENT ZONING**  
EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

\* ALL LAND IS DEPICTED IN THE SUBZONE WHERE IT WOULD BE CLASSIFIED IF ACQUIRED BY THE NPS  
FOR THE LOCATION OF PRIVATE LANDS, REFER TO THE LAND PROTECTION PLAN.

## INTRODUCTION

### THE ALTERNATIVES

This draft NPS general management plan contains two alternatives -the Park Service's preferred alternative and the minimum requirements alternative.

The preferred alternative meets the statutory proposals for visitor centers at Grants and Bandera Crater and recommends additional development, including facilities necessary for visitors to see representative monument resources without infringing on American Indian interests. The preferred alternative provides the necessary initial protection of the cultural and natural resources for this new unit of the national park system. The minimum requirements alternative contains the lowest feasible scale of action to make the monument operational and provide for minimal visitor use and resource protection (see later description for details).

Details important to an understanding of the monument's resources are presented in the "Affected Environment" section, and an evaluation of the impacts of each of the two alternatives is presented in the "Environmental Consequences" section of this document.

It should be noted that the two alternatives presented here are different than the alternatives presented in the *El Malpais Update* (public newsletter) issued in December 1988. The four alternatives in the *Update* were meant to elicit public opinion about the results of planning at an earlier stage when the options for visitor use and development were broader and not directed toward the most feasible solutions, which is the objective of this draft general management plan. With input from the public from the questionnaire in the *Update* and public meetings, and with detailed attention by the members of the planning team and many consultants to all relevant issues and legal and policy requirements, the preferred alternative contained in this document is presented for

additional public review. A summary of public involvement is in appendix B.

The planning process followed by the Park Service often includes a "no-action" alternative. However, a no-action alternative was not considered viable for this general management plan because the Park Service is required in the El Malpais legislation to include specific proposals for development of a multiagency center in the Grants area and a visitor center in the Bandera Crater area. Thus any alternative would include this action – i.e., proposals that these centers be developed. In effect, the minimum requirements alternative serves as the no-action alternative in this document.

### COOPERATIVE PLANNING

A key aspect of planning for El Malpais has involved cooperative planning - with the Bureau of Land Management, with American Indian groups, and with other interested organizations (the city of Grants, the Grants Chamber of Commerce, the Cibola Convention and Visitors Bureau, etc.). This summary of cooperative planning is presented to show how common issues have been resolved during the planning process.

During planning, NPS and BLM teams met several times and reviewed the significance of the national monument and the national conservation area. A list of interpretive objectives that would guide preparation of the alternatives for visitor use (access and interpretation) was compiled by the two teams.<sup>3</sup> After formulating the alternatives for both areas, the teams met again to ensure that these alternatives would not be in conflict and would serve the overall visitor experiences of the national monument and the national conservation area.

Cooperative planning for the multiagency center at Grants involved group workshops, which aimed at defining the objectives of that proposed facility. The planning included the NPS and BLM teams and

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3. These objectives can be found in the introduction to the "Visitor Services/Interpretation Plan" section of this document.

also representatives of the Forest Service, the New Mexico Departments of Tourism and Natural Resources, the city of Grants, Grants Chamber of Commerce, the Cibola Convention and Visitor Bureau, and the Pueblo of Acoma. Important guidance as to the geographic scope and the character of informational services and media resulted from these workshops.

Visitor use alternatives for the NM 117 corridor were of particular concern because of the important features in this area, the mutual **NPS/BLM** boundary along most of the corridor, and the concern of the American Indians about sites of religious significance and other uses of adjacent tribal lands. NPS and BLM planners agreed not to duplicate trail access onto the lava areas of Big South Narrows. They also agreed that different aspects of the prehistoric story warranted public access to both Las Ventanas in the national monument and the Dittert site in the national conservation area. The two teams recommended bi-agency information kiosks at both ends of the NM 117 corridor. The Park Service provided assistance in trail planning at La Ventana arch.

NPS design and engineering specialists consulted with the BLM planning team and reviewed their site alternatives for a ranger station in the NM 117 corridor. Potential water supply and limitations imposed by soils, floodplains, and highway access entered into the evaluation. The BLM planning process led to selection of a site east of NM 117, about 9 miles south of Interstate 40. This station would be built and staffed by BLM personnel and contain space for a resident ranger who would patrol and respond to emergencies in this part of El Malpais. By cooperative agreement, this facility could also distribute information on the national monument and assist the Park Service in monitoring use in adjacent parts of the national monument, including the Sandstone Bluffs and Las Ventanas area where archeological and ethnographic resources need to be protected.

Planners of both agencies consulted with authorities from concerned Indian tribes about areas that should be avoided because of their religious significance.

The results of these joint planning efforts for visitor use can be seen on the General Development map, which shows the distribution of visitor support developments of the two agencies along NM 117

(BLM proposals are in lighter type face). The text following the map details access and visitor use at the NPS areas and summarizes BLM proposals. Details of BLM proposals can be found in the BLM's draft general management plan.

Early in the planning, the Bureau of Land Management transferred their existing resource data on the national monument to the Park Service. The Bureau of Land Management also developed a geographic information system for the national monument and the national conservation area, including elevation, topography, slope, aspect, drainage, soil, and vegetation. This has led to identification of the biophysical land units shared by both the national monument and the national conservation area, and in the future the two agencies will be able to formulate interrelated resource plans that address fire management, models for archeological research and protection, and other topics.

During planning, the Park Service and the Bureau of Land Management divided some tasks of cultural resource evaluation. Historic themes and resources were compiled by consultants to the NPS team, and the ethnographic overview – leading to a comprehensive synthesis of existing data – was undertaken under contract by the Bureau of Land Management. (Future ethnographic studies will include the detailed information required by NPS policy and will cover both the national monument and the national conservation area.)

# THE PREFERRED ALTERNATIVE

## INTRODUCTION

Because El Malpais is a new national monument and has very little infrastructure for supporting visitor services and management, it is important that the preferred alternative effectively addresses the development needs while ensuring a high level of protection for the resources, including those important to American Indians. A summary of the preferred alternative is presented on the General Development – Preferred Alternative map.

The natural and cultural resources management plan sections, described later as part of the preferred alternative, are integral parts of the alternative, as is the wilderness suitability study.

The preferred alternative will take about 15 years to implement, and the various steps needed for implementation have been prioritized. Comprehensive design for facilities and surveys for archeological, ethnographic, and natural resources will be completed before any actions are undertaken; depending on survey results, details of the general management plan will be modified, as necessary, to mitigate adverse effects on these resources.

## MANAGEMENT ZONING

### The Zones

For NPS management purposes El Malpais National Monument is divided into three zones: natural/cultural, monument development, and special use (see Management Zoning map). These zones have been further divided into a number of subzones. This land classification framework provides essential guidance for monument development and administration and ensures a broad range of recreational experiences.

The **natural/cultural zone** will be managed to conserve the natural resources and processes of the monument, and to preserve, protect, and interpret its cultural resources (prehistoric and historic). Ethnographic resources, including sites of religious and subsistence importance to American Indians, will be protected. As per legal

requirements, American Indian access to these sites and privacy for their religious observances will be ensured. Public uses that are allowed within this zone will be those that do not adversely affect the resources and natural processes. The natural/cultural zone is further divided into the **primitive** and **semi-primitive subzones** (described in detail in appendix C).

Traditionally, natural and cultural resources are identified separately in management zoning frameworks. However, these two types of resources have been combined into one category at El Malpais because of

the close relationship between the natural environment and cultural sites,

the entire natural landscape being part of the cultural landscape,

the special religious importance of many of the culturally significant sites within the monument to one or more of the local American Indian groups (the identification of these sites in a specific zone could attract inappropriate uses that might compromise the integrity or sanctity of the sites), and

the knowledge of the location and extent of the numerous natural and cultural resources in the monument is so incomplete that their separate identification is not practicable at this time.

The **monument development zone** will be managed to provide and maintain the facilities necessary to serve the needs of visitors and management. This zone includes areas where certain development and/or use may alter the natural environment or the setting of culturally significant resources. To the extent possible, this **subzone** will maintain the natural and cultural character of El Malpais while accommodating visitor use and monument management activities. Any national register sites in this zone will be managed in consideration of the provisions of their designation. Development and use will be controlled in a manner that will provide visitors with a quality recreational experience. The monument

development zone is further divided into the **rustic** and **developed subzones** (described in detail in appendix C).

The **special use zone** includes the activities carried out on private lands within the monument boundaries. NPS administrative control over use of lands in this zone is either absent or is secondary to that of other parties. The special use zone is limited to a **transportation subzone** that includes the state highways and attendant rights-of-way.

The management zoning framework, including subzones, is graphically depicted on the Management Zoning map. Although this map shows the zoning for the entire monument, the proposed zoning will have no effect on nonfederal lands unless and until the Park Service actually acquires those lands or interests. However, the zones as shown indicate the management emphasis that would be placed on these nonfederal areas should they be acquired. It must be stressed that the integration of private property into management zones does not imply permission for public use of that property. Public use of these tracts will not be permitted until the lands are acquired by the federal government. Further, the regulatory stipulations of each zone or subzone do not limit the rights of private property owners.

Finally, it is important to recognize that any or all zones (including subzones) may contain resources that are either unidentified or whose significance is not yet fully determined. The management strategy in regard to the lands in federal ownership is to identify these resources through surveys, determine their significance, and prescribe their protection and treatment for preservation. Eligible cultural resources on federally owned lands will be nominated for listing on the National Register of Historic Places. Similarly, significant natural resources may qualify as units of the National Natural Landmarks program or be set aside as research natural areas and receive special management protection. The superintendent may declare special zoning designations in areas that are found to contain especially significant and/or fragile resources or that are needed for research purposes. Any special zoning designation that may be established will be managed under conditions specified by the superintendent.

## The Visitor Experience in the Management Zones

This section briefly describes the predicted type of experience visitors will have in the four subzones of the natural/cultural and monument development zones of El Malpais National Monument. Additional information on the frequency of encounter with other people, the character of interpretive media, and the standards of roads and trails are in the section of this document on recreational activities and in appendixes C and D.

In the **primitive subzone**, which has no roads and few marked routes, visitors will feel self-reliant and like they are exploring. They will find interesting features and at times commune with the beauty and harshness of their surroundings. Some visitors will orienteer to selected destinations, such as remote lava caves, but even then they will have a sense of original discovery as they explore in solitude.

In the **semi-primitive subzone**, with its relatively difficult access on rough roads and on simple marked routes, visitors will travel to features such as lava caves and collapses and feel immersed in an undisturbed land. They will have few reminders of the civilized world and will be largely reliant on their own observations to attach meaning to the natural and cultural landscape.

In the **rustic subzone**, with its gravel roads and well-defined trails, visitors will travel to interesting natural and cultural features and they can camp if they chose. They will have opportunities to learn about their surroundings through on-site interpretive media such as exhibits and pamphlets; however, they will also enjoy interesting natural features at their own pace.

In the **developed subzone**, with its visitor centers, paved and one-way tour roads, and gentle trails shared with numerous people, visitors will feel directed along a predetermined sequence of stops. There will usually be many other tourists around, some of whom will have limited time and are only seeing certain highlighted resources. Many of the monument's most significant and spectacular features are deliberately included in this **subzone** to give visitors with limited time or ability chances to see some significant and representative features of the monument.

## Jurisdiction

It is NPS policy to obtain concurrent jurisdiction within units of the national park system. The Park Service currently has only proprietary jurisdiction in El Malpais National Monument. Within the monument, concurrent jurisdiction will be sought for all areas except the NM 53 and NM 117 rights-of-way, which would remain in proprietary jurisdiction.

## VISITOR FACILITIES/DEVELOPMENT PLAN

The monument headquarters, visitor centers, operational facilities, roads, trails, viewpoints, and campgrounds are described in this section on visitor facilities. Proposed facilities will be designed for minimal damage to resources and to harmonize with the surrounding environment. Structures will be the minimal size necessary to accomplish their function, and trails and viewing platforms will be properly designed and constructed to discourage off-trail use. Nonreflective materials and natural colors will be used where possible, and signs will be the minimum necessary to guide and educate the visitor. Proposed facilities will also be designed for low-consumptive water use. (See appendix D for a description of the trail standards that are shown on the maps in this section and appendix E for a discussion of design guidelines for these facilities.)

Disturbed areas will be revegetated, restoring the natural resource values and visual integrity of these sites. This **revegetation/reclamation** would be carefully balanced with natural recovery (i.e., these areas would blend with the existing landscape, maintain genetic integrity, and prevent introduction/spread of exotic species). Only plant materials native to the site will be used for revegetation. Topsoil will be removed and stockpiled for use during reclamation. Mulch matting, silt fences, hydromulching, check dams, and other erosion reduction techniques will be used. Appropriate measures will be taken to protect cultural resources during the revegetation process.

Prior to construction, development sites will be surveyed and evaluated for federal and state threatened or endangered plant and animal species. An archeological survey will be undertaken prior to development. Facility development and increased visitor use will also be monitored over the life of the plan, providing the Park Service and other

federal agencies with updated information on local, federal, and state protected species.

It should be noted that all areas of the monument are currently accessible 24 hours a day. The preferred alternative considers that some of these areas will be closed during the night with lockable gates to protect monument facilities and resources or ensure visitor safety.

Following are site-specific development plans for the preferred alternative.

### Administrative Headquarters

Although currently in the former Forest Service building in Grants, the monument's headquarters will ultimately be moved to a place that will accommodate the staff as it grows to the proposed level (which is described in a later section on staffing). This location will be leased, located in Grants, and will meet the criteria for space and other NPS requirements. Grants is a central location and is the most effective site for the headquarters. There is currently an ample supply of reasonably priced rental space available in Grants. Placing primary administrative functions in the multiagency center or at the **Bandera** visitor center is undesirable because of the likely conflict of two functions in one building and because of the potential of administrative functions to impinge on visitor functions. Combining administrative and visitor functions in one building would also likely compound costs of new construction. (A larger visitor center would also increase impacts on the natural and visual environment.) Also, being in Grants, the monument staff will have convenient access to local, state, federal, and tribal officials with whom the staff must work on a regular basis.

### Multiagency Center, Grants

As shown on the following Multiagency Center DCP (development concept plan) map, under the preferred alternative the multiagency center in Grants will be convenient to a paved access road from the I-40 interchange at the east end of the city of Grants in a detached portion of the national monument. Approximately 481 acres of land will be acquired in fee, beginning from the southern I-40 right-of-way south to a common boundary with the conservation area. (As described in the section on

boundary proposals, the size and configuration of the existing 1,089-acre tract originally set aside for this purpose will be administratively adjusted. This adjustment is shown on the Boundary Proposal map in a later section of this document.) Effective signs will be provided on I-40. The purposes of the multiagency center are described in the "Visitor Services/Interpretation Plan" section.

Although adjacent to a busy interstate and a proposed industrial park (including a National Guard building), the multiagency center site will be distinguishable from adjacent uses, reflect a design that is indigenous to the region, and have an aesthetic appearance consistent with NPS design standards. The entrance will be easily identifiable. A distinctive name for the facility will be important (perhaps "Land of the Ancients"). The building will use passive solar energy, and external utilities will connect with existing lines from Grants.

Careful site selection will result in an optimal location for the facility. Designers will work with the Greater Grants Industrial Development Foundation to mitigate adverse effects of the industrial park that is planned, part of which is within existing monument boundaries near the visitor center site. (See "Proposed Monument Boundary Adjustment" section for further discussion of this situation.)

The approach road and landscaping for the building will adhere to the principles of quality design (as described in appendix E) and also ensure that the facility has ample surrounding space to maintain its visual integrity. Landscaping for the grounds and entrance road will be a blend of native trees, shrubs, grasses, and groundcovers. The parking area for the visitor center will have native deciduous shade trees, and because the parcel is relatively level the parking area will be screened from the I-40 interchange where feasible.

The main view from the visitor center will be the unobstructed southern panorama of both the monument and the conservation area. Because this view is important for orienting the visitor to the monument's geography, design will be conducted with special care.

The center will be fully handicap accessible and contain almost 7,000 square feet. A detailed discussion of the size and functions of the proposed visitor center is included in appendix F. The center will include the following:

an information/reception area, with information desk, orientation exhibits to features and activities in the area, and identification of the different agencies involved in the center

a publication display and sales area

a travel planning area where visitors can refer to information and maps to refine travel plans

an exhibit area with audiovisual (AV) units, in alcoves and/or as parts of exhibits

an AV theater

a plaza adjoining the building, which has shaded seating for summertime visitors to escape the sun, serves as a waiting area for family or group members, is a starting point for a short loop trail (with interpretation of features that can be seen from the trail), and which can be used for occasional talks and/or demonstrations by American Indian craftspeople

office/working space for employees of the facility

public restrooms

In addition to the National Park Service, agencies that have expressed at least a tentative interest in being represented in the building include the Bureau of Land Management, the U.S. Forest Service, the Pueblo of Acoma, the Ramah Navajo Chapter, the Grants Chamber of Commerce, and the New Mexico Division of Tourism.

All media for the center will be planned and designed by the NPS Harpers Ferry Center to ensure continuity of design. The other agencies and interested American Indian groups will be consulted relative to the resources and interpretive messages affecting their areas during this process.

The Park Service will design and construct the multiagency center. Agreements with other agencies will be negotiated relative to staffing and sharing the operational costs.

## Bandera Crater Area

The Bandera visitor center will be the primary interpretive facility for the national monument (see "Visitor Services/Interpretation Plan" section). With the roads and trails proposed for the Bandera Crater area (described below), the preferred alternative provides access to the monument's largest, most interesting and significant volcanic crater. Proposed development in this area will also provide visitors an opportunity to see one of the most interesting ice caves and the historic trading post complex.

The Bandera visitor center will be constructed approximately .7 mile south of the NM 53 junction (see Bandera Crater Area DCP). The site is gently sloping, in view of a prominent lava flow to the east, and just below the northeast side of Sandstone Ridge. The building site also has a northeast exposure, is dotted with evergreen trees and shrubs, and has sparse native grasses. The site faces a lava-edge ecotone of pinyon, juniper, and aspen trees that outline the west side of the lava flow. Major views from the site include Lava Crater, Cerro Candelaria, Sandstone Ridge, and the surrounding forest and meadows.

The visitor center will be representative of regional vernacular architecture. The grounds of the visitor center will be landscaped with native plant materials. Views to the local peaks and lava flow will be used in the design. A view deck on the east side of the visitor center will be oriented to these views and provide a designated area for interpretive talks relating to the resources. Parking will be screened with existing shade trees where feasible to soften the intrusion of the pavement. The design of the building will also take full advantage of the site's potential by using passive solar energy. The entryway will be easily distinguishable and offer basic visitor information.

The approximately 7,500-square-foot center<sup>4</sup> will be handicap accessible and include the following (a detailed discussion of the size and functions of the proposed visitor center is included in appendix F):

- an information/reception/circulation area, with an information desk

- a sales and publications display area, with storage and workspace

- an auditorium/AV room

- an exhibit room, with AV units in alcoves and/or as part of the exhibits

- NPS office space/workrooms and small storage area (for facility and district ranger personnel)

- a view deck, with a trailhead for a short interpretive trail to the margin of the nearby lava flow

- access to a trail to the top of Sandstone Ridge

- public restrooms

Access to the center will be a new two-way paved road off NM 53, approximately 1.3 miles east of the existing access road to the trading post. This new two-way road will be designed for cars and tour buses and will bring all visitors to the new visitor center just below the northeast side of Sandstone Ridge.

Two trails will begin at the visitor center. A nature trail east of the building will wind approximately .5 mile along the lava flow ecotone. This trail's purpose will be interpretive, bringing visitors in close contact with the variety of trees and shrubs and the jagged aa lava. A second trail will be constructed to the top of Sandstone Ridge where

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4. If the proposed Zuni Canyon Tourist Railroad (described under "Regional Recreation Resources and Use" in the "Affected Environment" section) is demonstrated to be feasible and is subsequently developed, certain modifications in the proposed facilities for the Bandera Crater area may be required. The railroad could increase the number of recreationists who would frequent the Bandera Crater area, which might require larger facilities than are currently proposed. Depending on the proximity of the terminus to the Bandera visitor center, it may be necessary to consider an increase in parking space and to develop a means of transportation between the terminus and the visitor center. If the preferred alternative is initiated, the National Park Service will work closely with local officials to ensure that the railroad will not compromise the quality of the visitor experience or the preservation of resources in the Bandera area.

there would be splendid panoramic views of the local craters, including **Bandera Crater** and **Lava Crater**. Mount Taylor (near Grants) and several areas on the east side of the monument would also be visible. This trail will continue on to the trading post, and another trail will branch southward to Spattercone Valley (see **Bandera Crater Area DCP** map).

Two-way traffic will end at the visitor center parking area, but a one-way paved tour road will continue 2.0 miles farther to a second new parking area just east of the trading post. This new parking area (designed in two or more small areas and not one large area) will be selectively sited to reduce impact on the natural vegetation, deter erosion, and prevent visual impact on the historic scene. This new parking area will have about the same capacity as the parking area at the proposed **Bandera** visitor center (37 cars). The existing historic parking area will not generally be used for parking vehicles, but may be used as a drop-off zone for maintenance supplies and emergency operations. The tour road will be designed for slow traffic speeds (25 mph) and tour buses; the need for pullout parking for scenic vistas will be considered during design. Careful alignment will be necessary to incorporate scenic vistas while minimizing disturbance of the easily erodible hillsides and natural vegetation as the road winds around Sandstone Ridge. Minimal interference with the natural water drainage along the lava flow margins will be incorporated into road design. This one-way road will enable visitors to approach the volcanic terrain of the area in a leisurely manner. A small picnic area with at least one wheelchair-accessible table will be provided near the trading post parking area. Both picnicking and parking represent a continuation of past and existing functions in this area.

The one-way tour road will continue .8 mile from the parking area near the trading post to NM 53 on an alignment that on the southern end is slightly east of the existing road. There will be lockable gates at the beginning of the one-way tour road and at the tour road exit to NM 53 to aid in management operations and resource protection.

There will be one intersection on the one-way tour road, which connects to a two-way .3-mile paved spur road to parking and a trailhead for Dripping Lava Cave and Lava Crater. The existing one-lane dirt road crosses a narrow segment of lava; it will be necessary to widen this crossing for two-way

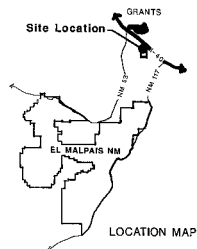
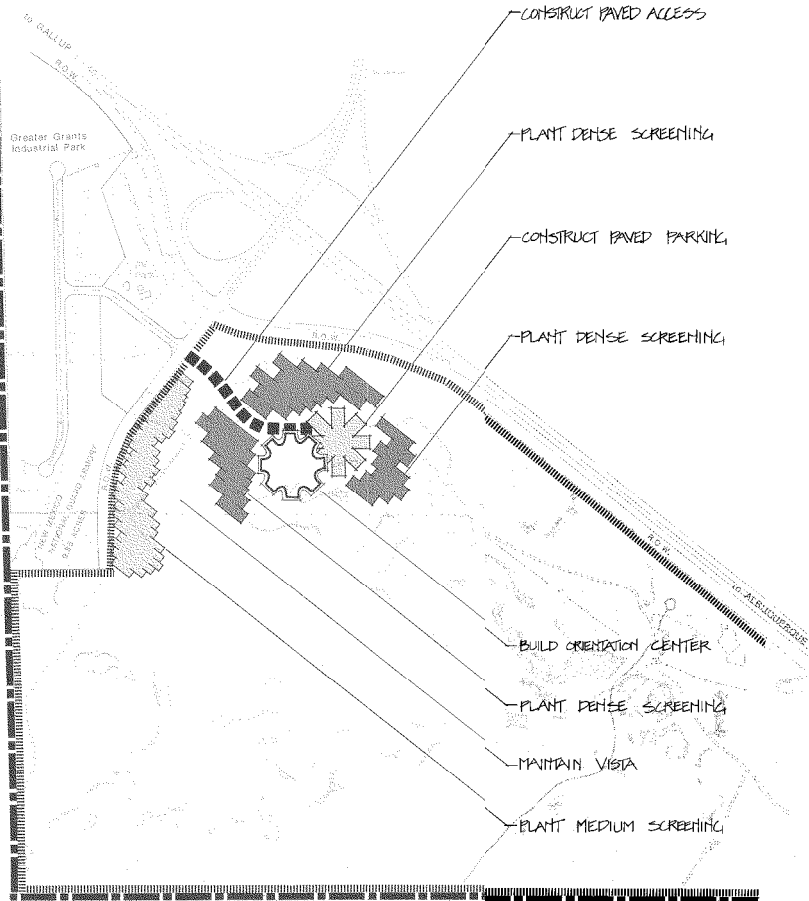
traffic. A new trail to Dripping Lava Cave and catwalk-like steps will descend into the precipitous entrance and continue to the end of the cave past features that include a perennial ice pond and dripping lava formations. (Dripping Lava Cave is one of the best opportunities in the monument for visitors to experience an underground “big cave.”) Electric lighting will be installed or the Park Service will provide lanterns or flashlights to use in the cave.

A trail climbing southward to the rim of Lava Crater will branch from the trail to Dripping Lava Cave. Because of the rough terrain at the rim of Lava Crater, this trail will not be a loop. (See **Bandera Crater Area DCP** and also the “Visitor Services/ Interpretation Plan” section for representations of the entire trail system proposed in the **Bandera Crater** area.)

To accommodate increased visitation and additional interpretive services, the existing Candelaria trading post will be rehabilitated in a manner compatible with its past history and function and used as a staffed/unstaffed information center for orienting visitors to the **Bandera** area and trail system. This historic structure may also serve as a shelter in inclement weather or as a meeting place for special events, school or bus tour groups, etc. The interior will be brought up to NPS health and safety standards. Although the narrow doorways and other structural features of the trading post currently make wheelchair accessibility difficult, it is a goal of the general management plan to provide handicapped visitors physical access to this structure.

However, prior to any modification of the structures or historic setting, a historic structures report will be prepared to document and analyze all periods of construction and modification, building techniques, source materials, evidence of use, and historic setting of the buildings, grounds, and related structures. Once the buildings have been brought up to NPS standards, a historic structures preservation guide will be prepared to direct preservation maintenance activities and provide orderly and timely inspection and upkeep of the structures.

Because the trading post complex (including the Ice Cave and **Bandera Crater**, which are used for religious purposes by the Zuni) is thought to be eligible for inclusion on the National Register of Historic Places for its significance in early-day New

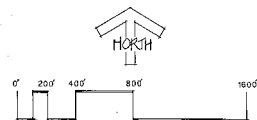


## MULTIAGENCY CENTER DCP

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

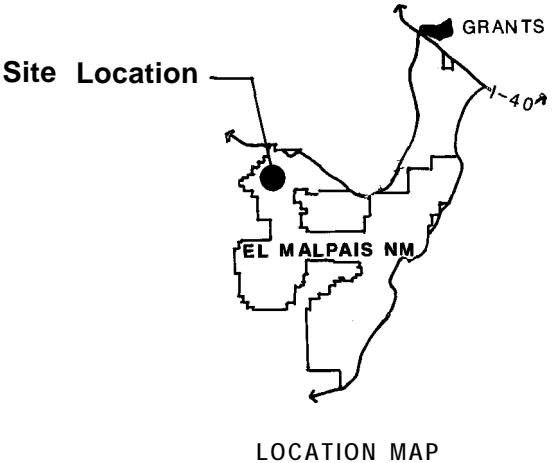
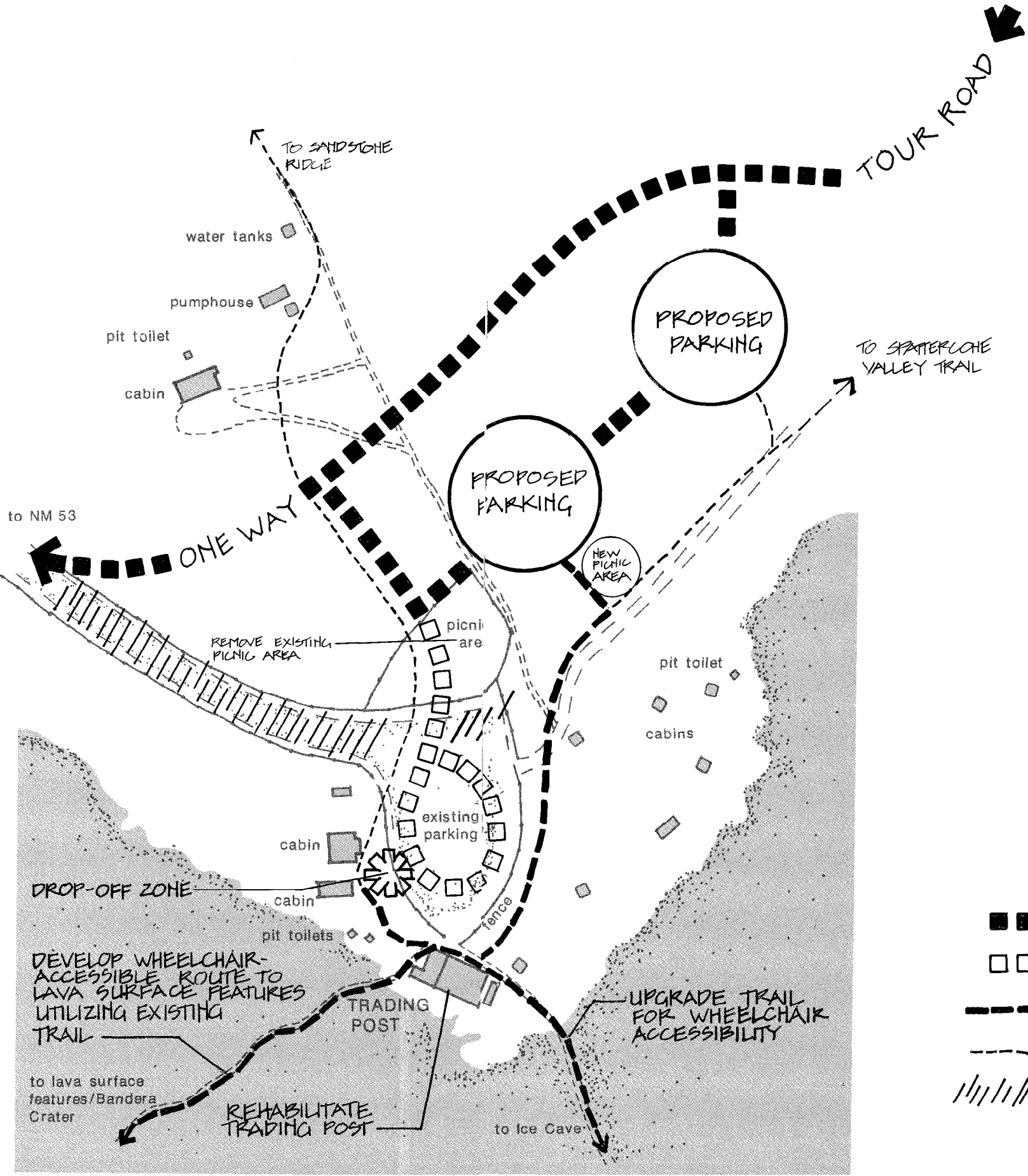
DEC/JULY 1998/103/20,017

LEGEND  
 HPS MONUMENT BOUNDARY  
 BLM CONSERVATION AREA  
 BOUNDARY



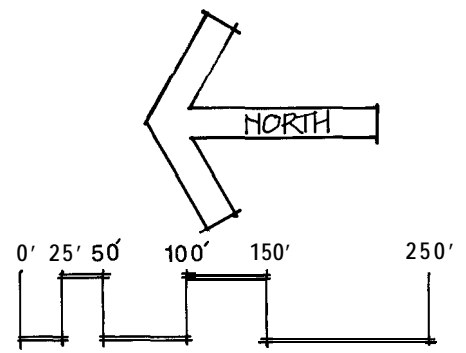
NOTE:  
BOUNDARY LINES, ROAD, PARKING, BUILDING LOCATIONS ARE  
APPROXIMATE. ACTUAL ALIGNMENTS TO BE DETERMINED.





**TRADING POST AREA DCP**  
**EL MALPAIS NATIONAL MONUMENT**  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE  
DSC/DEC 1989/103/20.019A

- LEGEND**
- ■ ■ PROPOSED PAVED ROAD
  - □ □ PROPOSED GRAVEL SERVICE ROAD
  - — — PROPOSED WHEELCHAIR-ACCESSIBLE TRAIL
  - - - HIKING TRAIL
  - /// /// /// OBLITERATE & REVEGETATE ROAD



Mexico tourism and for its traditional cultural importance to the contemporary Zuni, proposals for adaptive reuse and other modifications will be developed in consultation with the New Mexico State Historic Preservation Office, the Advisory Council on Historic Preservation, and American Indians prior to any structural or landscape changes.<sup>5</sup>

Two of the former tourist cabins will be rehabilitated and adaptively reused as restrooms, and another cabin will be stabilized, fitted with period furnishings (using existing furnishings to the extent possible), and interpreted as an example of an early-day tourist cabin (see Trading Post Area DCP). The exteriors of all of the original tourist cabins will be preserved, consistent with the historic structures preservation guide. All structures to be rehabilitated in the trading post area will be treated consistent with the secretary of the interior's "Standards for Rehabilitation." After compliance with section 106 procedures, noncontributing structures, including pit toilets, will be removed.

There will be a wheelchair-accessible trail between the parking area and the trading post. This trail and others described below will be carefully blended with the historic scene and compatible in materials and design; they will also meet NPS safety standards for the type of trail proposed (see appendix D on trail standards). Signs in the area of the trading post will be visually compatible with the setting.

The existing trail from the trading post to the Ice Cave will be improved, interpreted, and made wheelchair-accessible; this will require some regrading and use of ramps in short sections to meet the necessary standards. The steep wooden stairway into the Ice Cave will be replaced using compatible materials and design, keeping with the natural and historic scene and conforming with Uniform Federal Accessibility Standards. There will be a platform provided at the rim or in conjunction with the stairway structure so that visitors in wheelchairs can see the interior portions of the cave. These modifications will not be inappropriate, considering the 50-year continuum of changes in these features to facilitate visitor use.

A new wheelchair-accessible loop trail from the trading post to nearby lava surface features (spattercone and tree molds) will be provided and principal features interpreted; much of this trail will be on an existing alignment. The existing trail to **Bandera Crater** (the old motor tour route) beyond the spattercone will also be maintained and interpreted as part of the historic scene. The trail to **Bandera Crater** is composed of relatively loose cinder, which is subject to unsightly damage including scarring of steep slopes and loss of bedrock when visitors leave established trails. Signs will be posted on the trails where necessary for visitor safety and resource protection. Unauthorized off-trail use in the **Bandera** area will be monitored and controlled to minimize scarring and erosion of fragile cinder slopes. Using existing alignments of the Ice Cave and **Bandera Crater** trails, portions of which will be wheelchair accessible, is a significant mitigation in reducing disturbance of geologic features and cultural resources in the **Bandera** area and maintaining the historic scene.

There will be interconnecting trails to Spattercone Valley, Sandstone Ridge, and **Bandera Crater** (see **Bandera Crater Area DCP**). There will also be a new trail from the Ice Cave that intersects the trail to the summit of Cerro **Bandera** (described below in the description of East Rendija).

It is crucial that new construction such as trails and landscaping in the vicinity of the trading post exhibit a sense of unity and a sound functional relationship with the existing architectural elements of the trading post and cabins as well as with the natural landscape. That is, any new structures near the trading post will be compatible in form, style, mass, color, material, texture, and scale with the old.

An abandoned sawmill site, dumps, and ruins of cabins historically associated with the regional lumber industry are in the vicinity of the proposed visitor center in the **Bandera** area and will likely be obliterated by construction. Archeological testing and documentation will be completed prior to the final comprehensive design for the visitor center, and the sites will be mapped to document their location, size, and arrangement. It has been determined in consultation with the New Mexico

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5. National register forms are being prepared.

State Historic Preservation Office that these sites are not eligible for nomination to the national register.

Stone circles in the vicinity of **Bandera** Crater will be stabilized and interpreted to visitors as part of the area's prehistoric heritage.

To provide the facilities essential for interpreting and protecting the **Bandera** Crater area and other western portions of the national monument, four single-family residences, a four-unit apartment building, a four-bay maintenance building, and parking and utilities for monument personnel and maintenance operations will be built. Employees residing in monument housing will provide a 24-hour presence that will help deter vandalism and theft, and staff will be well positioned to make after-hour gate closures and respond to emergencies. The residences and maintenance facilities will be behind a forested hill, about .5 mile east of the visitor center (see **Bandera** Crater Area DCP). This location is within walking distance of the visitor center, yet it is fully screened from visitors by topography and forest. These buildings and associated facilities will be accessed from NM 53 by a new paved service road, about 1.3 miles east of the new visitor center entrance road. This road will skirt the western edge of a large open meadow at the base of a small bluff, then turn westward toward the proposed residential and maintenance area.

The architecture of the residences and apartment building will be consistent with the regional vernacular style and also use passive solar energy. Colors and materials will blend with the immediate environs. Each residence and the apartment building will have exterior landscape elements delineating private, semi-private, and community space. Minimal disturbance of natural vegetation will be a top priority in locating each structure and the parking areas. Careful attention will be taken to screen the residential area from the noise and visual intrusions associated with the maintenance area.

The maintenance area will be near the residential area for emergency responses and will consist of an elongated single-story structure with four parking bays, a workshop, a small office, and rescue/fire cache storage. The building will be of regional vernacular architecture, with materials and colors that blend with the immediate environs (the site

may be visible from public trails at Lava Crater and Sandstone Ridge). The design will use passive solar energy. Parking for most maintenance vehicles will be adjacent to the building, and the perimeter of the parking area will retain large trees and shrubs. Because of the often harsh winters, indoor parking space is needed for selected vehicles to ensure dependable operations during periods of cold weather and to retard the deterioration of the equipment. Heated and well-ventilated indoor work areas will be incorporated in the design to provide work space during winter months. A security fence will probably enclose the maintenance compound.

The cinder and borrow pits in the **Bandera** area will be recontoured and restored to natural appearance.

### **East Rendija Area**

Although the **Bandera** Crater area contains many spectacular volcanic features for visitors to see, the East Rendija area complements it with an array of lava surface and lava tube features that are not seen near **Bandera** Crater. These include a massive lava wall, enormous caves with "windows," and other phenomena that illustrate the dynamics of fluid lava.

Beginning northwest of Cerro **Bandera** and leading south from NM 53 will be a new, 6-mile, two-way, gravel-surfaced road that will lead to the Cerro **Bandera** trailhead and on to East Rendija (see East Rendija Area DCP). Several segments of the road will be elevated to avoid major maintenance problems, provide proper drainage (i.e., to prevent pooling on the roadway), and ensure reliable access to East Rendija by two-wheel-drive vehicles. The northernmost 2 miles of Route 42 east of Cerro **Bandera** will be completely realigned to the west side of Cerro **Bandera**, which will improve the dangerous sight distance at the NM 53/Route 42 intersection; the existing 2 miles of Route 42 east of Cerro **Bandera** will be closed (to eliminate views of vehicles and dust seen by visitors at **Bandera** Crater), and the abandoned section will be restored to its natural condition. The middle 2 miles will join the old alignment of Route 42 south of Cerro **Bandera**, and the last 2 miles will depart from Route 42 and approach East Rendija on the north side of Cerro Rendija (replacing the primitive high-clearance road that now exists). The southernmost 4 miles may or may not follow

existing alignments; however the entire 6 miles will stay at least .25 mile inside the monument boundary. (The first mile of this new road may require a future administrative boundary adjustment to be included inside the monument.

Along the road to East Rendija, new access and gravel parking will serve a new trail that ascends the western side of Cerro **Bandera** to its summit – the highest point in the national monument and a splendid 360-degree view of the surrounding region. The trail (about 1 mile) will require cutting some slopes of cinder and volcanic agglutinate. This will be mitigated by confining the **treadway** to areas of relative stability, selecting an alignment to minimize shortcutting, and by using side-tread logs, drainage bars, and retaining walls to minimize downslope loss of loose cinder.

A new 6-site (expandable to meet demand) primitive vehicular campground with tables and grates will be built east of the cutoff to East Rendija from Route 42 (see East Rendija Area DCP). The campground will be located on a site with good drainage (but not more than 3 percent slope) and will use existing trees for shade where possible. Each campsite will accommodate at least two vehicles and a maximum of eight people and will be designed to concentrate eating and sleeping activities in comfortable, well-drained areas. Ample spacing and native vegetation between sites will minimize noise and visual intrusions. Parking will be graveled, and there will be vault toilets at the campground. No water will be provided in this portion of the monument.

There will be a roadside **pulloff** and gravel parking area to serve a new loop trail to the lava wall feature prior to reaching East Rendija.

A gravel parking area and trailhead will be built at the end of the improved road to East Rendija. Vault toilets will be provided at the trailhead. New trails will be developed to Big Skylight and Four-Window caves, using flat lava surfaces for treadways wherever possible to promote safety and minimize resource damage. Access at appropriate standards will be provided into the caves. There will be primitive marked routes beyond these two caves to Seven Bridges and Caterpillar collapses. These trails will be marked, not constructed, and high-density recreational use in these areas with fragile resources will be discouraged.

## **Braided Cave**

This area provides yet another type of volcanic feature – a lava tube that has numerous reconnecting passages and colorful dripping lava features on the walls and ceilings. Road access to Braided Cave will be the existing primitive routes, except that the road just north of the cave will be gated just inside the monument boundary to prevent further vehicular access by the public. An unimproved dirt parking area will be provided at the gate, and visitors will follow a marked route to Braided Cave. No toilets or water will be provided.

## **El Calderon Area**

Several important lava tube features not present elsewhere in the monument are concentrated in the El Calderon area. These include the long Junction Cave, the deep impressive Double Sinks (caused by collapse of an underlying lava tube), and the well-known Bat Cave that is summer habitat of a large colony of Mexican free-tailed bats.

The existing dirt road to Junction Cave from NM 53 will be partly realigned and improved as a gravel road; a small parking area and trailhead will be provided near Junction **Cave**. The route to the entrance of Junction Cave will be marked, but visitors will explore it on their own. The new gravel road will be extended south from Junction Cave to a new formalized gravel parking area about .3 mile northeast of Bat Cave. Existing primitive roads in the area of Bat Cave will be closed and restored to natural conditions (see El Calderon DCP).

A new .3-mile trail will be built south to Bat Cave, and a new .2-mile trail will lead north to Double Sinks, both trails starting at the new parking area. There will also be a .2-mile trail from Double Sinks to Junction Cave (so that people can leave their cars at Junction Cave and walk to all three features). The trail to Bat Cave will be well marked and easy to follow under poor lighting conditions (the bat flights are at dusk). Vault toilets but no water will be provided at the new parking area. The east tube of Bat Cave will be closed for reasons of visitor health and safety and to protect the bats; viewing of the evening bat flights will be allowed

only from a safe distance in an area designated for that purpose. Exploration of the western tube at Bat Cave will not be encouraged because of its proximity to the east side, which is occupied by the bats. The preferred alternative allows continued viewing of the bat flights (an existing use) and also considers visitor safety and health and the sensitivity of the bats and their habitat. Studies to be initiated by 1991 call for a baseline biological study including population dynamics of the bat colony. It is the opinion of several scientists that public viewing of the bat flight is highly unlikely to have any disturbing effect on the colony. Unless the baseline study demonstrates an adverse effect, the preferred alternative relating to improved access to Bat Cave will be carried out.

The "Corral road" (northwest of El Calderon) will be kept open until improvements are made on the alternate road just north of El Calderon to support all local through-traffic leading south to the national conservation area. When these improvements are made, the Corral road will be closed and restored to natural conditions.

### **Zuni-Acoma/Acoma-Zuni Trail**

This 7-mile trail, a marked foot route across four of the five most recent lava flows of the monument, illustrates many surface lava flow features and gives visitors the opportunity to understand what crossing these badlands was like for prehistoric peoples and historic expeditions.

The access road from NM 53 into the parking area on the west side of the trail will remain as existing, but the gravel surface of the parking area will be maintained at a higher standard and the parking islands will be revegetated. The trail from the west end parking area to the viewpoint will be regraded and hard-surfaced to provide wheelchair access and will blend with the surrounding lava. There will be no toilets or water provided at the trailhead (see Zuni-Acoma DCP).

The east end of the trail is not in federal ownership (see description of existing trails in the "Affected Environment" section). If possible, an easement will be acquired from the Acoma for a trail, trailhead, and a small parking area at the east end of the trail.

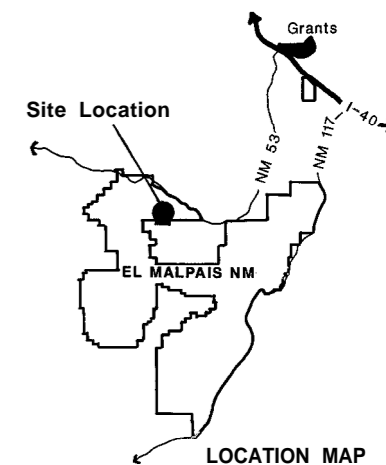
### **Las Ventanas**

The Las Ventanas site is one of the southernmost outliers of the major prehistoric Chacoan system and was an important regional center to the Chaco people. With its tower kiva and great kiva, Las Ventanas stands impressively on the edge of the sandstone bluffs that overlook the El Malpais lava flows. In 1981, the partially excavated tower kiva was backfilled by the Park Service and the Archeological Conservancy to prevent deterioration of the walls.

Las Ventanas is cited in the establishing legislation as an important site for visitor enjoyment and understanding of the Chaco culture; however, it is also special to the Acoma. The preferred alternative seemed the only feasible compromise for development at the site. Although a trail is proposed under the preferred alternative (see Sandstone Bluffs/Las Ventanas DCP and following description), the visitor experience will be controlled because of ranger patrols, carefully aligned and marked paths, and wayside exhibits that will explain the importance of staying on the trails and respecting the resource. The Park Service has chosen to present two options for Las Ventanas. The difference between the two options is only the manner in which the tower kiva will be presented for public viewing.

**Option 1.** For visitor access to Las Ventanas, a new .5-mile paved spur road will be built west of the first curve in the Sandstone Bluffs road. The spur road will lead to a paved parking area. Access to Las Ventanas will be by a 1.3-mile trail that begins at the parking area and continues northward along the sandstone rim to several features – a large natural arch, viewpoints of El Malpais, a prehistoric roomblock associated with Chacoan habitation of the area, the tower kiva and great kiva, and traces of a prehistoric road. Neither kiva will be excavated or stabilized. The trail will be carefully routed to avoid impacts on cultural resources or native vegetation. (Interpretive exhibits with photographs will show how the tower kiva looked before it was backfilled by archeologists in 1981.) There will be no access to the Las Ventanas trail at night, controlled by the gate on the Sandstone Bluffs road at NM 117 (see below). This gate will offer more control and protection of the Las Ventanas site.

**Option 2.** This option is identical to option 1 except the backfill will be carefully removed from the tower



# EL CALDERON AREA DCP

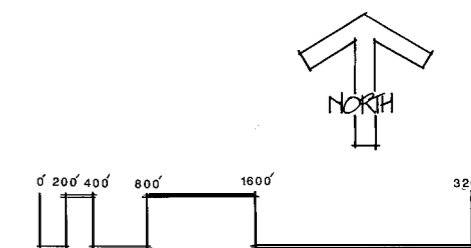
## EL MALPAIS NATIONAL MONUMENT

### U.S. DEPARTMENT OF THE INTERIOR

### NATIONAL PARK SERVICE

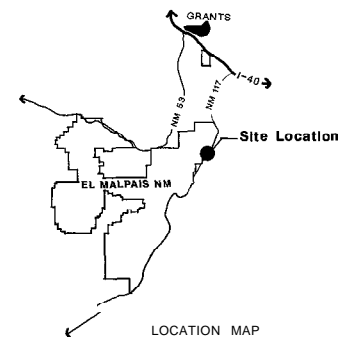
DSC/DEC 1989/103/20,015A

- LEGEND**
- PROPOSED GRAVEL ROAD
  - \*==\*==\*==\* CLOSED ROAD \*
  - - - - - PROPOSED TRAIL \*\*
  - ⊗ PROPOSED GRAVEL PARKING
  - ⊗ NATURAL/CULTURAL FEATURE

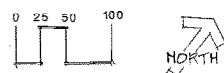
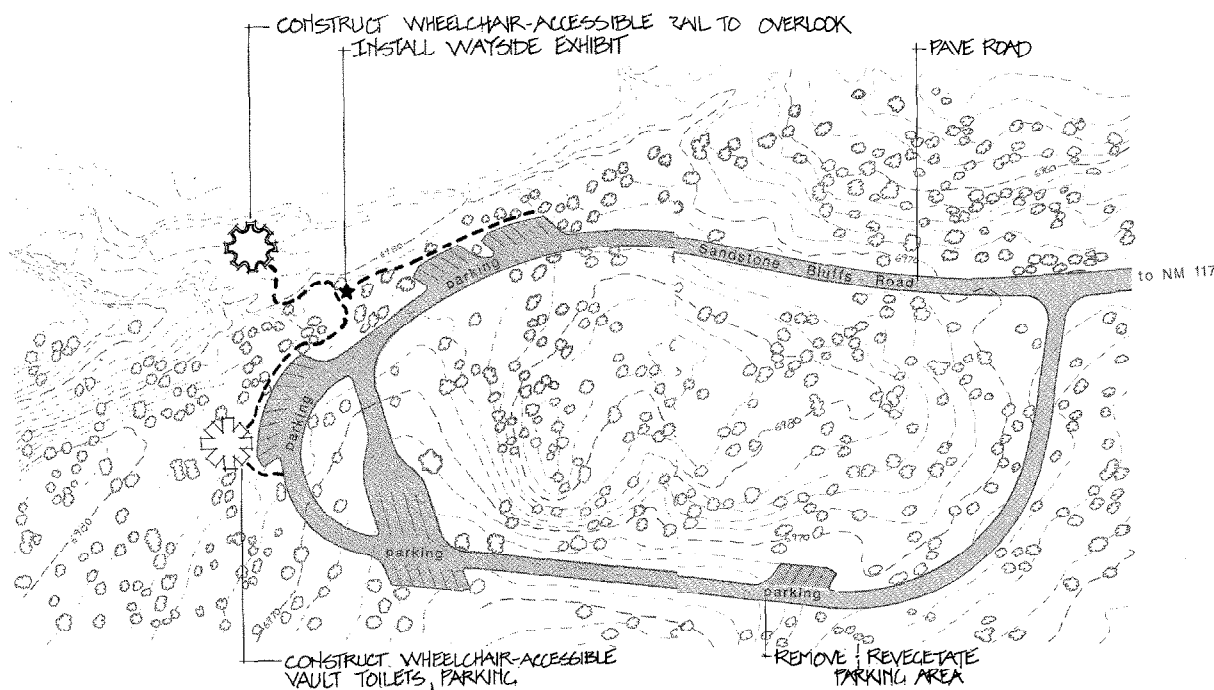
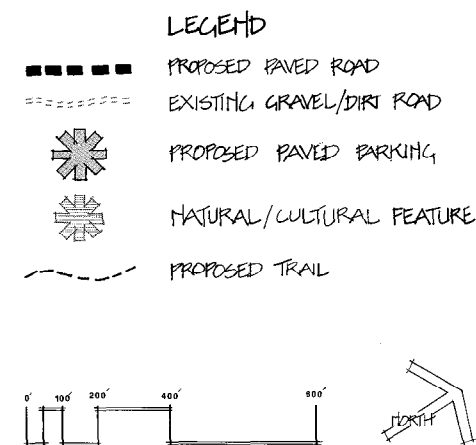
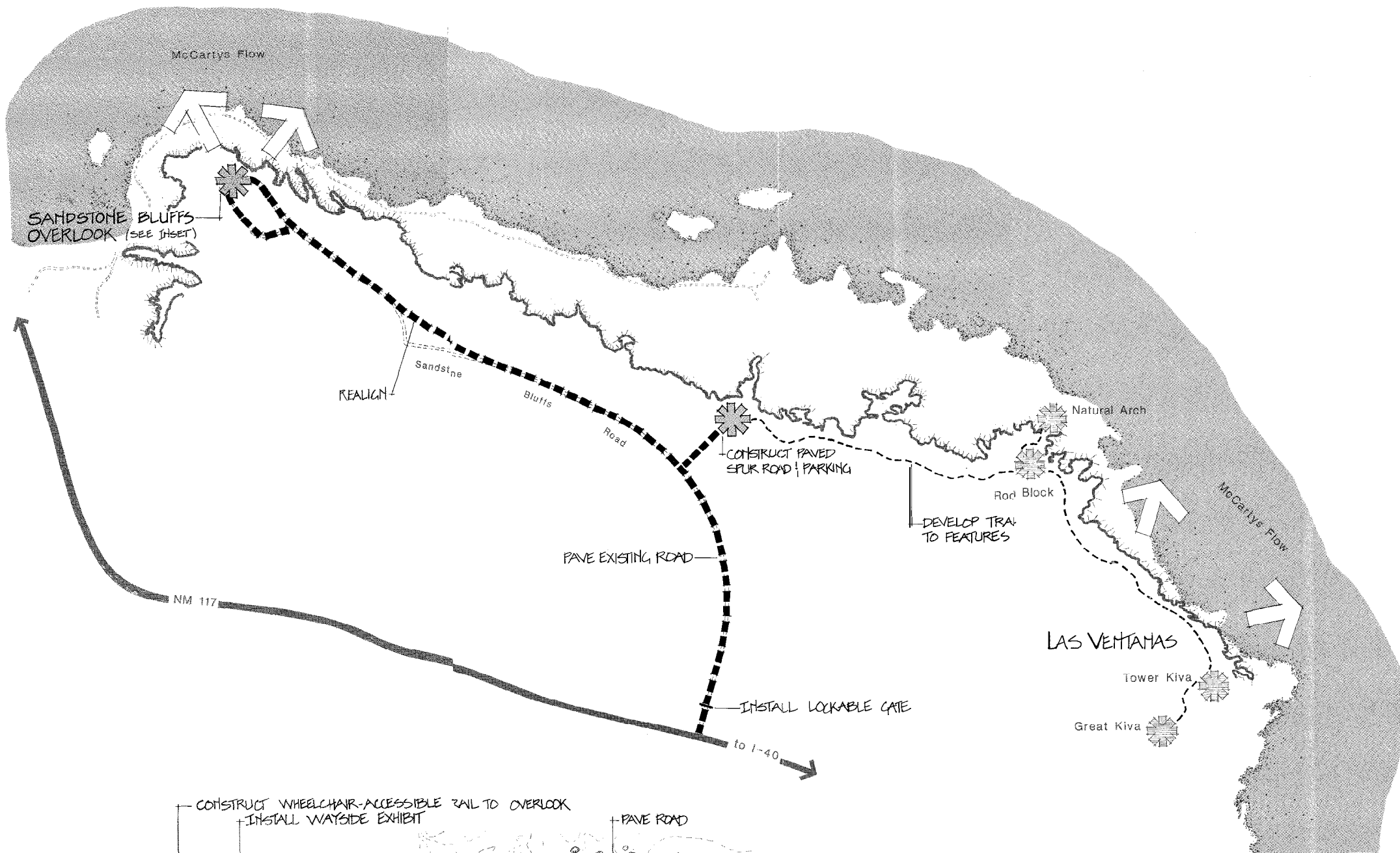


\* CORRAL ROAD WILL BE CLOSED AFTER IMPROVEMENTS ARE MADE TO EL CALDERON ROAD.  
 \*\* TRAIL ALIGNMENT IS APPROXIMATE. ACTUAL ALIGNMENT TO BE DETERMINED.

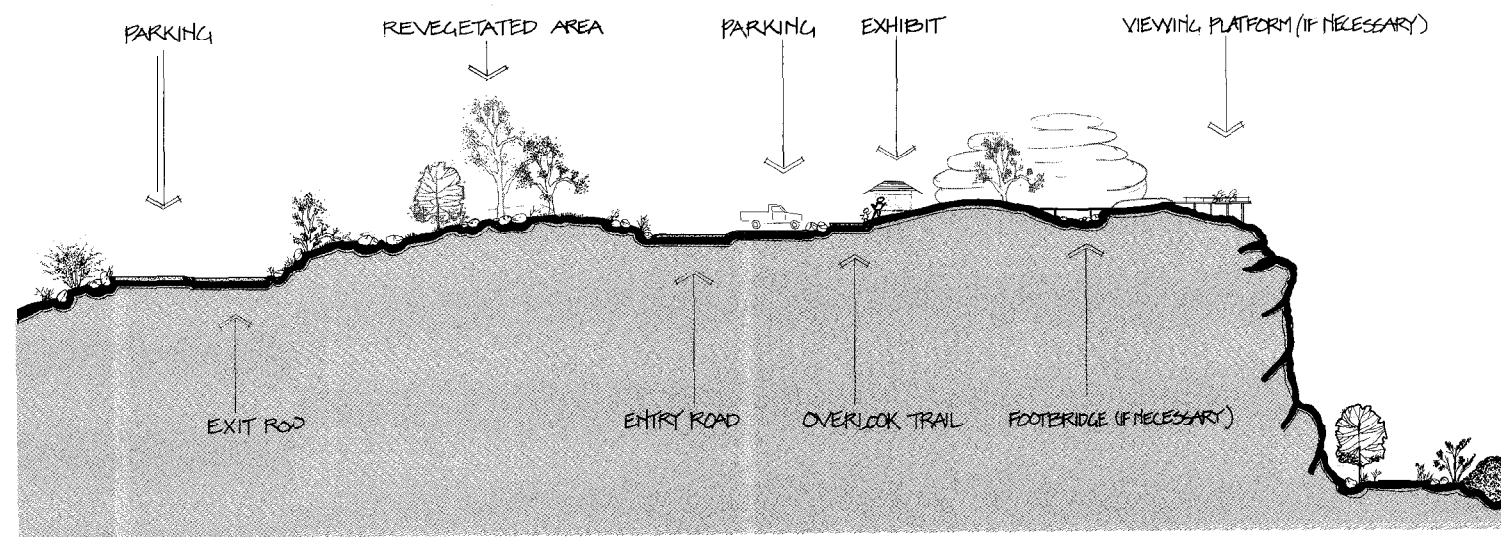




# **SANDSTONE BLUFFS / LAS VENTANAS DCP** EL MALPAIS NATIONAL MONUMENT U.S. DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE DSC/JULY 1998/10/3/20,012



PLAN VIEW - SANDSTONE BLUFFS



SECTION - SANDSTONE BLUFFS (NO SCALE)

kiva and the circular outline of the base of the kiva will be stabilized to give visitors a direct view of the character of the structure.<sup>6</sup> However, this option will entail significant expense and possible damage to the resource.

Following fill removal, masonry will be stabilized, drainage will be controlled, and measures will be developed to help protect exposed artifacts from erosion and vandalism. Cyclic maintenance will be necessary. This work will be guided by a recognition of the archeological, architectural, and religious importance and integrity of the site.

Because Las Ventanas is listed on the National Register of Historic Places, consultation with the New Mexico State Historic Preservation Office will be necessary prior to implementation of this option.

### **Sandstone Bluffs Overlook**

This overlook provides the only opportunity for visitors to orient themselves to the principal landscape features of the monument by looking out over the lava flows. To continue and improve this traditional visitor use, the existing gravel-surfaced road to Sandstone Bluffs from NM 117 will be paved under the preferred alternative, with one sharp curve realigned to improve vehicular safety. (As mentioned above, there will be a new spur road from this road to the parking and trailhead for Las Ventanas.) The parking area at Sandstone Bluffs overlook will be modified and paved, and wheelchair-accessible vault toilets will be added adjacent to the wheelchair-accessible parking spaces. Trampled areas will be revegetated and native vegetation protected. The loose soils in the area will be stabilized with engineering fabric and base aggregate.

A wheelchair-accessible trail to the overlook will be provided. The trail will be as compatible as possible with the sandstone outcrops, and cutting sandstone surfaces to accommodate the trail will be avoided to the greatest possible extent; smooth, well-drained

natural sandstone surfaces will be used in level areas if possible. The trail will possibly end at the viewpoint at a stone or concrete structure large enough to contain wheelchairs and accommodate other visitors – need for this structure would be determined during trail design. All facilities will be designed to minimize visual intrusion on this sandstone landscape while providing easy access and safety (see Sandstone Bluffs/Las Ventanas DCP).

There will be a lockable gate on the Sandstone Bluffs road at NM 117 that will be closed at night, thereby helping protect the visitors and resources in this area.

Several old stone buildings in the vicinity of Sandstone Bluffs will be evaluated for their significance and integrity – possibly as part of a historic resource study (see “The Plan for Cultural Resources Management” section).

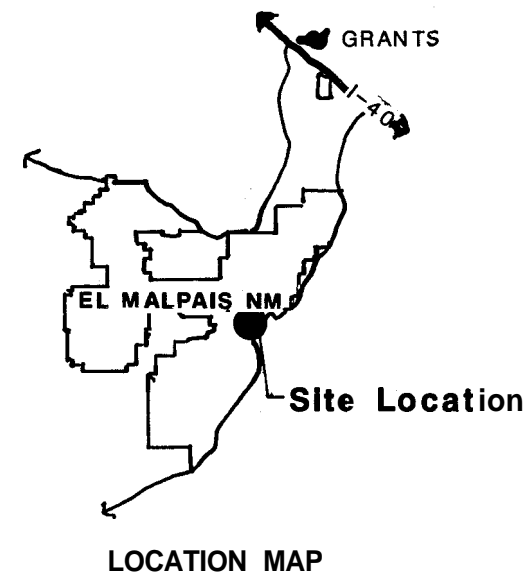
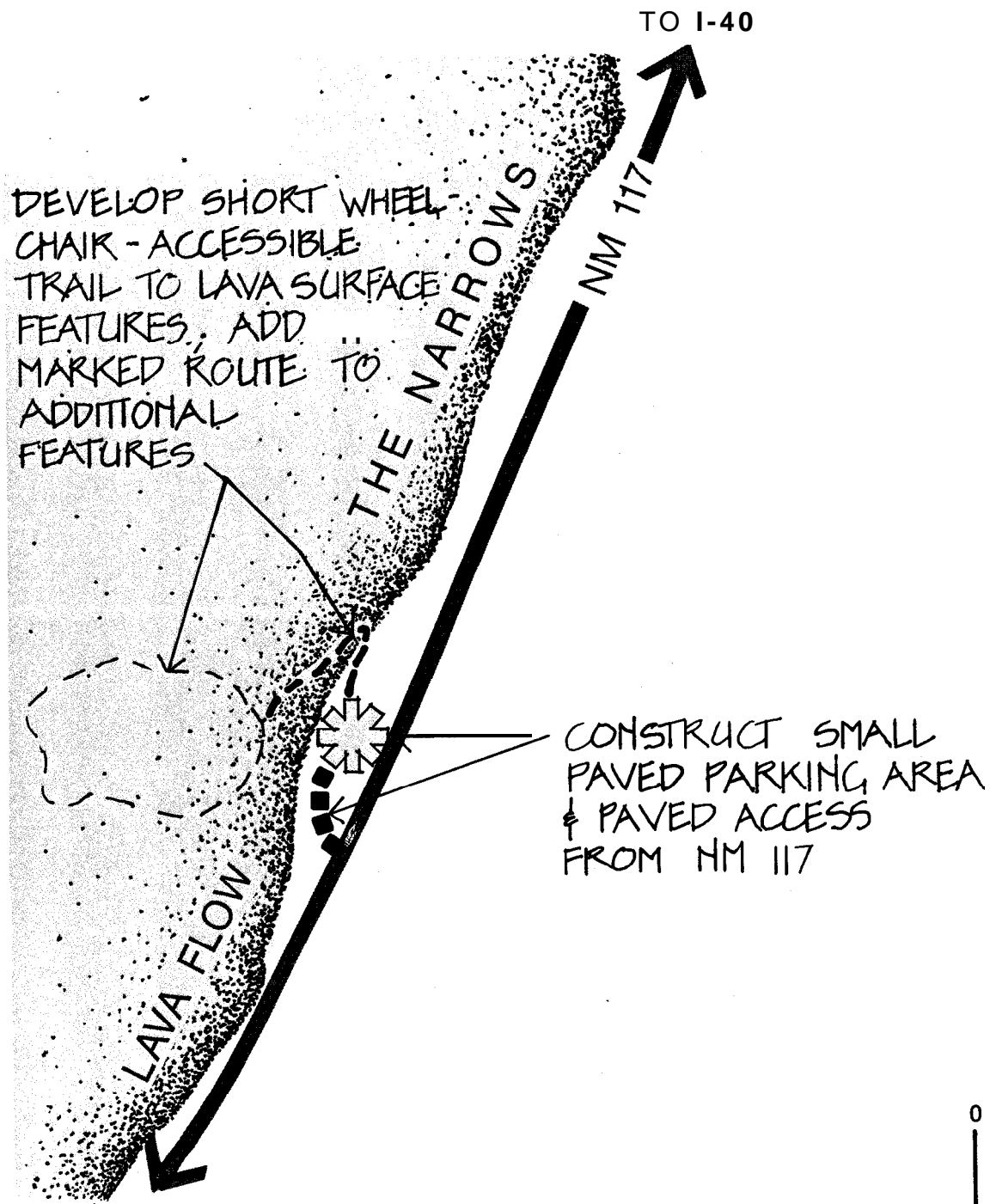
### **The Narrows**

Several areas along NM 117 were examined as potential sites for visitor access onto the impressive McCartys lava flow. All but one – the Narrows – were rejected because of fragile biological resources or the presence of areas important to the Acoma Indians. There will be a small near-road paved parking area for about six vehicles at the Narrows. Because the lava edge adjacent to the road pools surface water after storms, adequate drainage will be incorporated into the final design.

A short wheelchair-accessible ramp and boardwalk for viewing the lava surface features and dwarf trees will lead onto the McCartys lava flow. The boardwalk will allow visitors in wheelchairs to experience a few representative lava features in a short distance. Beyond this point, because of topographic constraints, the trail will not be wheelchair accessible. However, an additional marked loop trail will continue onto the adjacent pahoehoe flow area (see The Narrows DCP).

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6. It should be noted that there are other examples of Chacoan Outliers open to public view in northern New Mexico. However, this option would provide a viewing experience for visitors at El Malpais.



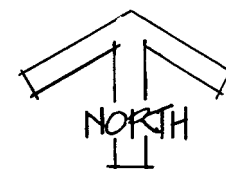
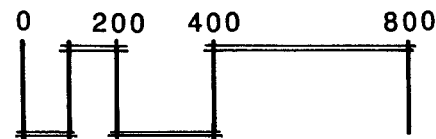
# THE NARROWS DCP

## EL MALPAIS NATIONAL MONUMENT

### U.S. DEPARTMENT OF THE INTERIOR

### NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,018



## McCartys Crater Viewpoint

The natural appearance of this area is already disturbed because of a quarry, and extensive work will be needed to rehabilitate the site.<sup>7</sup> However, this is the most impressive place in the monument to see the source of the immense McCartys flow from its small crater. Thus, the Park Service is presenting two options for McCartys Crater viewpoint.

**Option 1.** A new .1-mile spur road from NM 117 will terminate at a new paved parking area and trailhead. A short trail will be developed to a viewpoint overlooking the lava flow and McCartys Crater (see McCartys Crater Viewpoint DCP). Also, an orientation wayside will be placed near NM 117 to inform northbound visitors of the features ahead in the national monument and conservation area.

**Option 2.** Alternately, there will be no access or development at McCartys Crater viewpoint. No action would preclude the impact of construction and eliminate the risk of visitors walking beyond the viewpoint into areas that may contain unexploded ordnance.

## Roadside Kiosk Along NM 117

Provided option 2 (no development) is selected for McCartys Crater viewpoint, an orientation/information kiosk will be built near the south entrance of the monument/conservation area along NM 117 (refer to General Development – Preferred Alternative map). The kiosk, an open-air/shade structure developed cooperatively by the Park Service and Bureau of Land Management, will have a paved parking area, be visually prominent yet compatible with the scenery, and provide visitor orientation to features ahead in the national monument/conservation area.

The Park Service will also join the Bureau of Land Management in planning for a kiosk on NM 117 near the north entrance to the monument/conservation area and/or for exterior exhibits at the BLM ranger station (described below).

## Other Facilities Along NM 117

The Bureau of Land Management's *Draft* General Management *Plan* proposes additional visitor use facilities along NM 117. These facilities are mentioned briefly here to give the reader an overall picture of all visitor activities along NM 117 (refer to General Development – Preferred Alternative map).

There will be a 2,700-square-foot ranger station/public contact station, with paved parking for about 30 cars and five RVs or busses and an interpretive trail that would highlight local flora and landmarks. Included would be an information/reception foyer, book sales and display areas, storage space, and office and residence for seasonal employees. A well would be drilled to provide water for restrooms and drinking water. The site is about 9 miles south of I-40 on NM 117 (in section 32, T 9 N, R 9 W). (The Bureau of Land Management would like to begin construction of the building in July 1990.)

There will be a new gravel parking area and loop trail to La Ventana natural arch. The trail will be wheelchair accessible to a photo point. Vault toilets will also be provided.

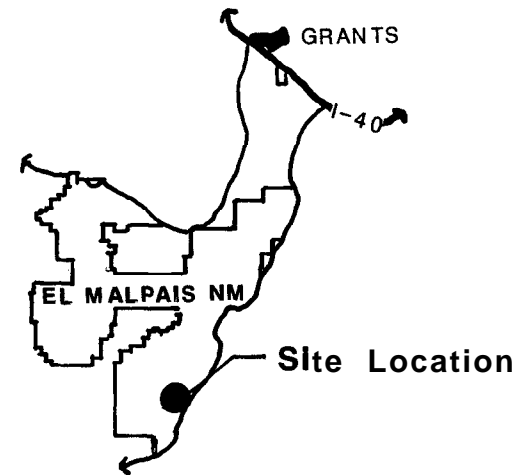
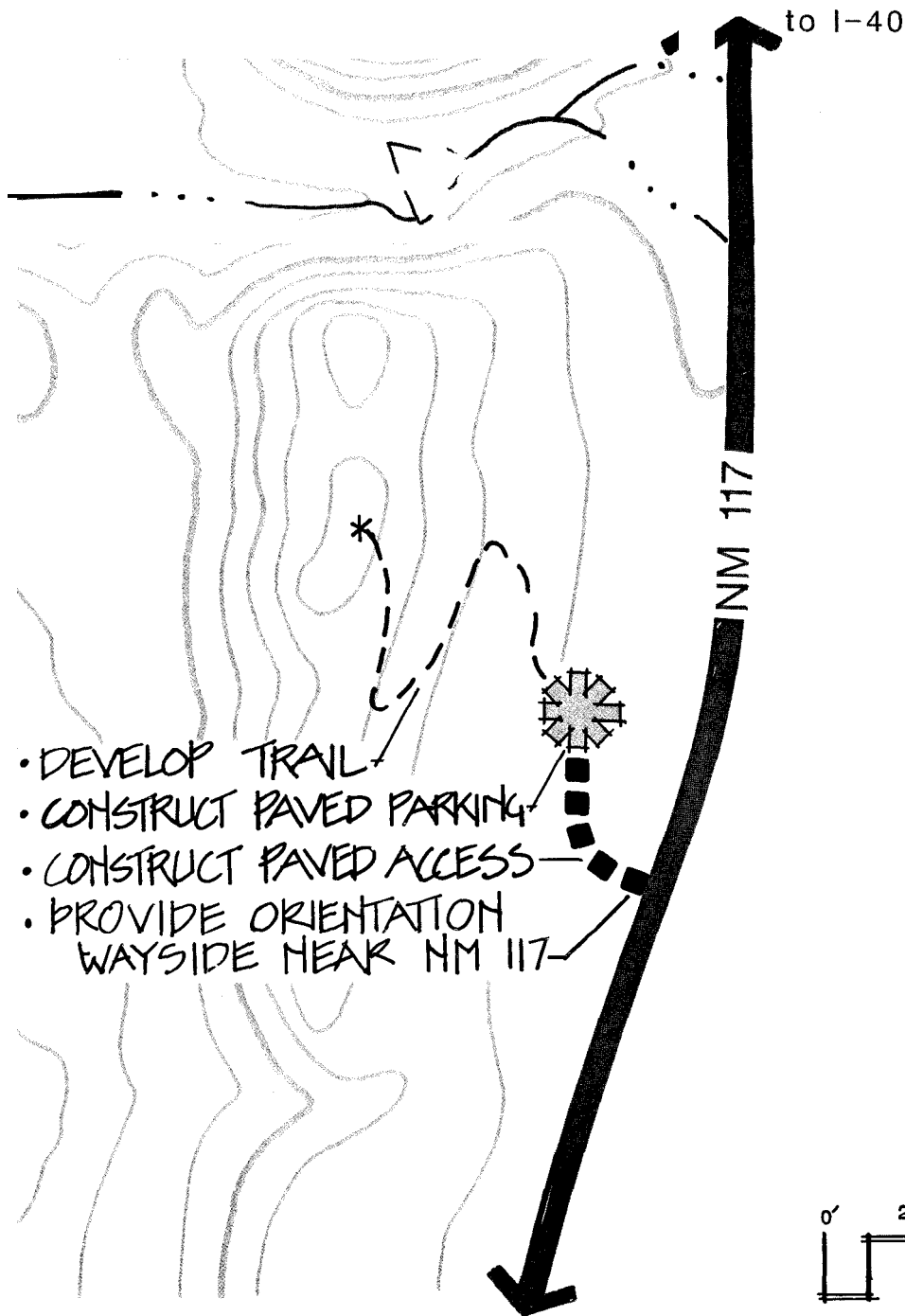
At the south end of the Big Narrows, the access will be redesigned and a gravel parking and picnic area provided. There will also be a trailhead and a trail leading into the Cebolla Wilderness.

Improved access will be provided to the Dittert archeological site; there will be gravel parking and a short trail to the site.

Also, the Pueblo of Acoma has expressed an interest in developing their Kowina Foundation property. Based on future consultation, the Park Service and the Bureau of Land Management could extend technical assistance to the tribe toward this objective.

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7. Because McCartys Crater is part of a past military bombing range, there is the remote possibility of unexploded ordnance in the area. The Park Service is negotiating deactivation and removal of all bombs and related objects from the area with the Department of Defense.

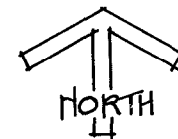
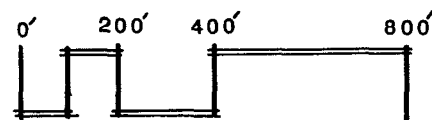


LOCATION MAP

## McCARTYS CRATER VIEWPOINT DCP (OPTION 1)

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,021



## Concessions

Because of the close proximity of the monument to the communities of Grants, Milan, and Ramah, there is no need for concession facilities in the monument. The three communities provide adequate services for the projected number of visitors. Commercial services available in Grants/Milan/Ramah (merchandise sales, food and beverage service, motor vehicle fuels and service, and lodging) are currently not being used to capacity, and there is potential for considerable growth in the service sector of these communities, as well as on private lands closer to the monument.

Sales of publications relating to the monument and its interpretive themes will be undertaken at outlets in the two visitor centers by a nonprofit cooperative association. Currently, the Southwest Parks and Monuments Association has been authorized to assume this role.

## Facility Capacity

Recreation visits to the monument are projected to increase substantially during the next seven years, with the highest concentrations occurring in the Bandera Crater area. To accommodate projections, a new visitor center, roads, parking, and trails will be constructed at Bandera as described previously. The plan contains mitigations to confine visitors in such a way that resource damage will be minimized, and other areas will be monitored for adverse effects and steps taken as necessary to alleviate these effects.

The location of facilities, especially parking, greatly influences the use of frontcountry and backcountry areas. Parking areas will be located in sites with potential for expansion to help alleviate potential adverse effects on resources and the visitor experience. There will be at least 90 parking spaces dispersed in the general Bandera Crater area alone, including the visitor center. Trails in the Bandera Crater area will be designed for visitors with differing skills and preferences. Trails will be routed in loops, wherever feasible. More than 10 miles of trails will be available in the Bandera Crater area, and there will be more than 25 miles of trails available within the monument.

Table 1 itemizes the parking capacity along all monument road corridors once the preferred

alternative is implemented. These capacities are based on visitor projections for 1995. When the design phase for these facilities is initiated, the capacities will be reevaluated and, if necessary, adjusted in consideration of actual visitation and revised projections at that time. From these capacities, the theoretical maximum number of persons at one time (PAOT) was calculated by multiplying the average number of persons per car (2.8) times the number of parking spaces. (The NPS nationwide average is 2.8; El Malpais as yet has no data.) The PAOT has been rounded to the nearest "whole person." The PAOT total also assumes that four tour buses (each averaging 30 passengers) will enter the monument each day. Campground sites are calculated for two vehicles and eight people maximum per each site.

The theoretical daily capacity of persons was derived by totaling the PAOT and multiplying that by a turnover rate of five (based on a 10-hour use day with a 2-hour average length of stay). Backcountry sites, the East Rendija campground, and tour buses have a multiplier of 1. Site-specific turnover rates were not used to calculate daily capacity because in several cases the length of stay is only 10 or 15 minutes or visitors do not stop at all; thus, the results would be grossly inflated and of little value.

Further expansion of roads, parking, and other facilities will occur only if it is determined through a visitor impact management analysis that the new facilities are inadequate and additional visitor facilities can be accommodated without causing unacceptable deterioration of natural and cultural resources or visitor experiences.

## Special Populations

The lobby, auditorium, exhibit area, and restrooms associated with the multiagency center and the Bandera visitor center will be wheelchair accessible. Where possible, select exhibits and programs at these two centers will accommodate the sensory and mentally handicapped. These two centers will also provide information on the location of facilities throughout the monument/conservation area that are designed for the handicapped. The design for these two visitor centers will incorporate signing, curb cuts, parking space striping, ramps, and other appropriate accessibility considerations. Wheelchair-accessible trails will be provided to the

**TABLE 1: PARKING CAPACITY ALONG ROAD CORRIDORS - PREFERRED ALTERNATIVE**

<b>SITES SERVING FRONTCOUNTRY*</b>	<b>VEHICLE SPACES</b>	<b>THEORETICAL MAX. PAOT</b>	<b>THEORETICAL DAILY CAPACITY</b>
Multiagency center	47	132	
Bandera visitor center	37	104	
Trading post	37	104	
Dripping Lava Cave	15	42	
Cerro Bandera	6	17	
East Rendija trailheads	15	42	
El Calderon	15	42	
Zuni-Acoma (west)	15	42	
Acoma-Zuni (east, if feasible)	6	17	
Sandstone Bluffs	27	76	
Las Ventanas	6	17	
The Narrows	6	17	
McCartys Crater	6	17	
<b>Subtotal</b>	238	669	x5 = 3,345
East Rendija Campground"			
12 (sites) x 8.0 people	=	96	+96
<b>Subtotal</b>		765	3,441
4 tour buses" (x 30 passengers)	=	120	+ 120
<b>Subtotal</b>		885	3,561
<b>SITES SERVING BACKCOUNTRY**</b>			
Braided Cave	4	11	
Cerro Encierro	4	11	
Other entry points	4	11	
<b>Subtotal</b>		33	33
Frontcountry		885	+3,561
<b>TOTAL</b>		918	3,594

\*Average length of stay is predicted at two hours or less.

\*Average length of stay is predicted at full day.

Ice Cave, lava surface features near Bandera Crater, the Zuni-Acoma trailhead and overlook (west end), Sandstone Bluffs overlook, and a portion of the lava features at the Narrows. There will also be a wheelchair-accessible viewing platform at the Ice Cave for visitors in wheelchairs or those who are not able to use the stairway. The cumulative effect of these opportunities will provide special visitors with a quality experience at a representative portion of the monument's resources.

Any new visitor or employee facilities and any alterations to existing facilities will comply with the appropriate laws and regulations, including the Architectural Barriers Act of 1968 (42 U.S.C. 4151 et seq.) and the Rehabilitation Act of 1973 (29 U.S.C. 792 et seq. and NPS-28). The preferred alternative must also comply with NPS Management *Policies* that state, "to the greatest extent possible, commensurate with physical limitations, the handicapped should be able to enjoy the park using the same facilities as the nonhandicapped visitor. Special interpretive facilities and programs for handicapped people are encouraged where good potential for participation is indicated."

## Water Development and Use

Congress directed the Park Service to preserve the significant natural and cultural resources of the lava flow area and manage it for the benefit and enjoyment of present and future generations, which includes the resource of naturally occurring water. Operating staff and visitor facilities will require a water supply for consumptive use. To carry out this congressional mandate, the Park Service needs the legal right to the necessary water. This legal right to water will be secured through state appropriative and federal reserved water rights.

The monument is in an area that is currently involved in a general stream basin water rights adjudication (Rio San Jose Basin Adjudication, State of New Mexico v. Kerr-McGee Corp., et al., Nos. CB-83-190-CV and CB-83-220-CV). The United States has joined in this adjudication, which began prior to the establishment of the monument. The court has ordered the United States to submit its claim to water for the monument by June 1, 1989. Appropriative and reserved water rights for the monument will be claimed in this adjudication.

After securing water rights, attempts will be made to develop a ground water supply for domestic purposes. If drilling is successful, water for the Bandera visitor center, trading post area, and the NPS residential and maintenance areas will be served by a new well adjacent to the NM 53 corridor in the Bandera area. A 75,000-gallon tank immediately north of Sandstone Ridge near NM 53 and underground pipelines will store and deliver water to all four areas. If water from the proposed well proves of inadequate quality to treat on site, is of insufficient volume, or is too costly to develop, water will be hauled to the storage tank from a local supplier. Water-saving appliances will be standard throughout area. Both the well and storage tank will be screened from public road and trail corridors.

Septic treatment systems and leachfields will be used at the Bandera visitor center and residential and maintenance areas. Chemical or low-water consumption toilets will be provided at the trading post. Mound sanitary discharge systems may be required in developed areas where soils are shallow.

## Other Utilities

Because there is single-phase power in the monument on an aerial line just north of NM 53 near the Bandera Crater area and the only source of three-phase power is 12 miles west of the monument in the Ramah area, the Park Service will make every attempt to design its facilities and utilities at Bandera to use single-phase power, including power for shop and maintenance purposes and water-well pumping. Any new electrical lines within the monument that will be visible to visitors will be placed underground to the greatest extent possible.

Telephones will be provided at the principal developed areas at Bandera Crater, placing lines underground when practicable.

Radio communication will be provided for the monument using repeater stations in or outside of the monument (the sites have not yet been selected but are under study).

## Potential for Earthquake and Volcanic Damage

Because of the general management plan alternatives for the Bandera Crater area and other volcanic areas in the monument, it is important to assess the long-term stability of the terrain as a safe place for use and development. Seismically – that is, from the standpoint of earthquakes – Laughlin and West (1976, 7) state: “It should be noted that the Zuni area is one of low seismic activity.” Volcanically -that is from the standpoint of future eruptions of lava and cinder damaging property or endangering human life – it is important to realize that basaltic volcanism of the type represented in the monument almost always begins with natural warning signs that allow hours to days advance notice before actual eruptions. Humans can be evacuated in a timely manner. The Bandera visitor center, residential/maintenance area, the one-way tour road, and the historic trading post complex all occupy lower valley slopes or valley bottoms, and could be destroyed by future eruptions of cinder and lava. However, there is no way to predict exactly where such eruptions might occur in the large Bandera lava field, and there is reasonably little chance that monument developments would be directly affected. The low incidence of eruptions within the time frame of human activity (perhaps 10,000 years ago in the Bandera area) precludes a reasonable risk of capital investment being damaged. In summary, there is no significant expectation of earthquakes or volcanic activity endangering life or property at Bandera or in other parts of the monument.

## Floodplain Compliance

There is only one floodplain in the monument, in the southern portion of the existing multiagency center tract. With the proposed boundary adjustment, this floodplain will no longer be within the monument and flood hazards will not affect human life and property within the areas being proposed for development within the monument.

## VISITOR SERVICES/INTERPRETATION PLAN<sup>8</sup>

### Introduction

The rugged 114,992-acre volcanic landscape of El Malpais National Monument is well known to many people who live in the immediate region. Nationally, however, El Malpais is virtually unknown as a vacation destination. Currently, the only tourist attraction within the monument is the small, privately owned and managed “Ice Cave and Bandera Crater,” approximately 25 miles southwest of Grants on NM 53 (see Existing Conditions map). Approximately 45,000 visitors per year see these two volcanic features at Bandera. An admission fee allows visitors to walk trails to various lava flow features, including the Ice Cave and Bandera Crater. The vast remaining portion of the volcanic badlands in the monument still offers few structured opportunities for visitors.

The preferred alternative will provide visitors with reasonable access and an opportunity to experience a representative portion of the resources of this unusual volcanic landscape. Because this newly established area has had little previous use, visitor interests, the number of visitors, and visitor use patterns are difficult to predict. Although the visitor use sites selected for the preferred alternative will provide a representative experience, only those few sites specifically mentioned by the legislation or sites that provide other primary experiences will be intensively developed. Other visitor use sites will be minimally developed and provide only basic access with no major structural development.

Various types of interpretive media and programs will convey specific themes; however, the overall media concept for interpretation throughout the monument will focus on and contribute collectively to accomplish the following objectives:

To instill in visitors a love and respect for El Malpais by viewing it from the perspective of local American Indians.

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8. This document contains more visitor services proposals in greater detail than normally included in a general management plan; that is, it contains media recommendations and is therefore more on the level of an NPS interpretive prospectus.

To provide the sense that this is a special place where if one invests the time one can feel the spirit of El Malpais and find one's heart and mind at rest.

To give visitors an understanding of the complex ecological relationships and the place of humans within those relationships.

To enhance visitor understanding of the forces that created this rugged landscape, encouraging firsthand experiences at selected features.

To give visitors an understanding of the transition from the Chacoan era to present times.

To provide the information necessary to ensure visitor safety and protection of the cultural and natural resources.

The primary visitor services/interpretation actions will occur in the following areas (refer also to the General Development – Preferred Alternative map):

a new multiagency center adjacent to I-40 (as required by the legislation)

a new NPS visitor center at the Bandera Crater area (as required by the legislation) and associated paved vehicular access to Dripping Lava Cave trailhead and to the historic trading post and Ice Cave/Bandera Crater trailhead.

The supporting interpretive sites (also shown on the General Development – Preferred Alternative map) include the following (refer to the development concept plan maps in the previous section for a description of the actual development in each area):

Las Ventanas/Sandstone Bluffs

East Rendija area

Braided Cave

El Calderon area

the Zuni-Acoma Trail

the Narrows

## McCartys viewpoint

entrance/orientation kiosk along NM 117

The following discussion describes the interpretation that will complement the development/facilities/trails described in the previous "Visitor Facilities/Development" section. In other words, it is the intent of this section to describe what visitors will see, learn, and experience if the preferred alternative is implemented. It should be noted that the planning and design for all interpretive media for the monument (described in this section and in appendix F) and the conservation area will be professionally done, coordinated between the Bureau of Land Management and the Park Service, and similar in visual appearance throughout El Malpais. American Indians will be consulted regarding the development of interpretive messages that are related to them. Public education in visitor centers and through other media will carry messages to help reduce damage to cultural and natural resources, including delicate geologic features.

Parts of this section stress how the needs of local American Indian groups will be met at El Malpais. However, there is another role Indians will play in the national monument. Indians are among the visitors who will come to El Malpais to tour the visitor centers and see the features along the trails. Some will be from the local area, and others from more distant places. Interpretation of the cultural landscape through the eyes of American Indians should be interesting to everyone. It is important that this theme be interpreted well at El Malpais, in an accurate and inspiring way so that people of Indian ancestry will enjoy the resources and feel encouraged to recommend how to improve the interpretive programs.

## Multiagency Center, Grants

**Signs.** Interstate 40, a major cross-country route, parallels the northern boundary of the national monument/conservation area. I-40 actually bisects one of the northernmost lobes of the McCartys lava flow, but exposes a mere fringe of the total volcanic landscape. Few travelers realize that this small area of volcanic rock is only a sample of spectacular lava flows that extend southward for

another 35 miles. Most interstate travelers have no idea that they are passing a unique opportunity.

For many, the first contact with the national monument and conservation area will be the interstate signs (both east and west of Grants) identifying the exit for the multiagency center. These interstate signs will most likely identify El Malpais National Monument/National Conservation Area and contain the name of the multiagency center. Because the terms El Malpais and badlands have no direct correlation to volcanism, it is necessary that either the name of the multiagency center and/or additional descriptive phrases be used on these interstate signs to convey the true identity of this resource – a volcanic landscape.

### **Interpretation - What Visitors Will See and Learn at the Multiagency Center.**<sup>9</sup>

Details about interpretation at the multiagency center, such as exhibits, audiovisual (AV) media, etc., are in appendix F; however, an overview of interpretive objectives of the facility is provided below. The functions and size of the multiagency center (described in the “Visitor Facilities/Development Plan” section and in appendix F) will not be repeated here.

The new multiagency center for El Malpais will serve dual purposes. It will be a travelers’ information/orientation center, providing visitors with information on areas of interest in the region. Such information will encompass El Malpais National Monument/National Conservation Area and western New Mexico (areas within an **easy** drive of the Grants/Milan area). The other purpose will be dissemination of Masau Trail information to interstate highway travelers. (As described previously, the Masau Trail is a vehicular tour route along existing roads that links prehistoric and historic cultural sites in New Mexico and eastern Arizona.) The multiagency center and its interpretive media will serve as the central point for the Masau Trail, an integrative approach to interpreting and awakening visitors to the prehistory and history of part of the Southwest. The center will not be a “destination” interpretive facility; rather it

will provide “stage-setting” interpretation and information and entice visitors to go see the outstanding resources of El Malpais, the region, and the Masau Trail for themselves.

The key to fitting this large and diverse amount of information into a single visitor service facility is brevity – exhibits will be limited to primary themes. Some of the exhibits will be designed to arouse interest and motivate travelers to visit El Malpais National Monument/National Conservation Area and other nearby U.S. Forest Service, state, and American Indian sites. Other exhibits will pertain to the Masau Trail, giving travelers an idea of what to see along the trail and where the areas are in relation to the center. These exhibits will not tell the visitor so much about any of the areas that they will not want to see them firsthand.

The exhibit area in the visitor center will deal with two generic but interrelated themes – the changing landscapes and environments of the region and the human record of occupation from the prehistoric Anasazi cultures to the contemporary American Indians. Concentrating on these broad themes will convey a central interpretive message about the cultural landscape that is highly relevant to the resources of El Malpais and the local region as well as those of the Masau Trail.

Between the reception area and the trip planning/exhibit areas there will be large topographic relief models or graphics that depict the El Malpais lava fields (designed to show geological components) and the larger region (designed to orient visitors and interest them in traveling to the various sites depicted).

There will be exhibits about the land – for example rock samples that help visitors identify the various types of features associated with the landscape, coupled with an AV unit or photographs that place the samples in context with the environments they came from. There will be other exhibits (artifacts, photographs, and graphic materials) about people associated with the land. These exhibits will help visitors learn about the American Indian cultures

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9. The following discussion of the center is based in part on the results of interagency workgroups that were held in New Mexico during October and December of 1988 (summaries of these workgroups are in appendix G) and also on meetings with representatives of the National Park Service, Bureau of Land Management, and the Acoma, Ramah Navajo, and Zuni Indian tribes.

that have occupied the area for more than 1,000 years and provide a reference to events that were happening in other parts of the world during the same time. One exhibit will show current Indian reservation boundaries compared with earlier territories. An alcove in the exhibit area will present another video program that deals with the relationships, feelings, and understandings of the different peoples for this land -this special place, El Malpais. This video will be very specific to the El Malpais area and will perhaps identify some of the features of the landscape while presenting a number of different speakers -for example members of the Acoma, Laguna, Ramah, and Zuni tribes, and representatives of the Park Service and the Bureau of Land Management – discussing what they see, feel, and value about the land. The objective of this video will not be to teach the differing philosophies or beliefs of the different peoples (an objective at the **Bandera** visitor center – described below); rather the objective at the multiagency center will be to point out that there are differences and that we should respect others' viewpoints as well as the land and shared resources. This video will interest visitors in seeing and learning more about this special place and the people who love and respect it.

A 15- to 20-minute interpretive film about the Masau Trail will be produced for showing in the AV theater. The film will emphasize the traditions of the Puebloan culture, including its contemporary descendants and prehistoric Pueblo cultures that are geographically within the Masau Trail region.

## **Bandera Crater Area**

**Bandera Visitor Center.** The **Bandera** visitor center will be the primary interpretive facility for the national monument. This center also has an important cross-cultural and trans-time story to relate. More details about interpretation at the center, such as exhibits, wayside exhibits, AV media, are in appendix F; however, an overview of interpretive objectives of the facility is provided below. The functions and size of the center,

described in the previous “Visitor Facilities/ Development Plan” section and in appendix F, will not be repeated here.

The AV presentation will be the focus of interpretation at the visitor center, its purpose being to convey the message that El Malpais is a special place and why and to present the relationship between American Indians and the land. The rugged landscape will be portrayed as a cultural landscape” where the land and culture are related. The messages will instill in the visitor a feeling for the landscape and the American Indian people who occupy and still rely on it. The AV will provide a window into the world view of other cultures and, if successful, will build respect for each other and encourage everyone to recognize land values in a different light.

There will be an exhibit area that complements the AV presentation by highlighting specific aspects of the cultural landscape. Some exhibits will emphasize the evolution and sequence of landforms – both the lava flows and the sandstone formations. Another exhibit will present some of the unusual ecological adaptations of the flora and fauna, including the bats, kipukas, inverted life zones, faunal and floral diversity, and dwarf forests. Another exhibit will highlight past and present cultures that have had contact with or been influenced by El Malpais' landscape, including the post-Chacoan culture, various European cultures, and contemporary American Indian cultures that have direct ties to El Malpais.

Once visitors leave the **Bandera** visitor center, many will choose to visit the Ice Cave and **Bandera** Crater. These two features have long been recognized as primary tourist attractions. Visitors will reach these two features along a one-way park road (designed for low speed) that reveals the aesthetic qualities of the landscape through which it passes. For many this road will provide an opportunity to slow down and leave the rush of civilization behind and will serve to heighten anticipation for the experiences to come.

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10. A cultural landscape is a geographic area containing both cultural and natural resources characterized by use by contemporary peoples, including subsistence hunting and gathering, religious or sacred ceremonies, and other traditional uses. See the cultural landscape discussion in “The Plan for Cultural Resources Management” section of this document.

**Dripping Lava Cave/Lava Crater.** The trading post, the Ice Cave, and Bandera Crater will be the primary destinations for most visitors; however, visitors who choose can make one stop before reaching these features. A spur road, parking area, and trailhead will provide access to Dripping Lava Cave and Lava Crater. An orientation/safety wayside at the trailhead will ensure that visitors are prepared for the experience. A short .3-mile trail will lead to the entrance of Dripping Lava Cave. A wayside exhibit at the mouth of the cave will describe how this 2,000-foot-long lava tube cave was formed and help visitors anticipate a few of the features found inside. Catwalk-like steps will provide safe access to the cave floor, and a well-engineered trail will provide access along the length of this enormous underground chamber. For visitors who plan to stay at El Malpais only a short time, this may be their only opportunity to see what it is like in a world of subterranean darkness. Dripping lava formations, ice-water lakes, an immense overhead dome, and other flow formations will all contribute to this unusual cave experience. Electric lighting will be provided or visitors will be provided with lanterns or flashlights for their visit into the cave.

Another segment of the surface trail will lead to Lava Crater. The trail to the crater rim will be routed to take advantage of views. A wayside exhibit, if appropriate at the trailhead, will contrast this crater to the other types of craters found in El Malpais, describe how they were formed, and present any significant themes or symbolism associated with these types of landforms.

**Historic Trading Post Complex.** The existing historic trading post complex will be adaptively used as a staging area and trailhead for Bandera Crater, the Ice Cave, and the lava surface features trail (described below). The trading post building, other structures that contribute to its historic significance, and selected artifacts will be retained to maintain a historic scene reminiscent of early pioneering efforts in tourism. (The Park Service may acquire selected cultural artifacts currently on display at the trading post. These objects may be used for display here or in exhibits at the multiagency center or Bandera visitor center.) One of the cabins will be stabilized, fitted with period furnishings (using existing furnishings to the extent possible), and interpreted as an example of an early-day tourist cabin. A wayside exhibit will be used to interpret the historic scene and highlight themes associated with

the site, allowing today's visitors to contrast themselves with tourists of yesteryear. Any new development, such as wheelchair-accessible trails, will avoid intruding on the historic scene and blend architecturally with the rustic surroundings. A new 37-car parking area and picnic tables will be provided just east of the trading post.

A portion of the trading post building, designed to function with or without staff, will provide orientation and information to help visitors select trails. A map or graphic exhibit will show the trails and identify lengths, difficulty, time requirements, special features associated with each trail, and any necessary safety information. A small cooperating association sales space (separate and securable when staff are not available) will provide visitors who did not stop at the visitor center a chance to obtain interpretive publications. Interpretive pamphlets and other materials will be distributed.

The remaining portion of the trading post will provide meeting space for special groups on a reservation basis. This space will be set up as a nature center workshop room. For example, school groups will use this space for pre-trip orientation and interpretive presentations.

**Ice Cave/Lava Surface Features Trail.** Two modern trails (both wheelchair accessible) will start from the trading post – one to the Ice Cave and the other to the lava surface features that are near the beginning of the trail to Bandera Crater (refer to the Bandera Crater Area DCP for orientation to the trails described below). A new stairway will be built for entry to the Ice Cave, and a special platform will allow wheelchair visitors and others who are unable to manage stairs to see the ice. A wayside exhibit will highlight the process that formed this cave and its ice features and explain how the ice maintains itself through the summer; the exhibits will also explain the significance of ice caves to humans, focusing both on prehistorical and historical uses of this important source of water.

A short .5-mile lava surface features trail (wheelchair accessible) will offer visitors a special experience in lava terrain. This trail will include aa and pahoehoe lava, a spattercone, lava cast tree molds, and a cinder landscape. A wayside exhibit will describe the formation and significance of these volcanic features.

**Bandera Crater Trail.** The Bandera Crater trail (part of the old motor route) will continue beyond the lava surface features trail and lead to Bandera Crater. There will also be a connector trail (also part of the old motor tour route) to Bandera Crater that will originate from near the Ice Cave. A wayside exhibit for the crater will show visitors how violent explosions and eruptions created this crater and adjacent lava canyon. One wayside exhibit will focus on the breached south wall of the crater and the upper visible portion of the 16-mile lava tube system that starts at the crater. Another wayside exhibit at a new inner crater overlook platform will dramatize the view of the interior of the monument's best-known cinder crater. Unlike most craters in the area, the inner portion of Bandera Crater is much deeper (200 feet) than the terrain around its base.

A wayside exhibit will also be used to interpret selected features along the two trails to Bandera Crater. Blocky lava, pahoehoe plates, picturesque trees in twisted and contorted shapes, collapse features, and prehistoric circular rock walls are just a few of the features that will be interpreted. Two short spur trails, with wayside exhibits, may also be constructed depending on the environmental suitability of the sites. One trail would lead to Coffin Tube (a surface lava tube with an unusual rectangular profile) and another to Lichen Sink (a 75-foot deep collapse structure with an ice-water spring and colorful mosses, lichens, and algae growing at the entrance). If visitor access to Coffin Tube and Lichen Sink is determined environmentally suitable, these features may alternatively be included as part of ranger-guided walks in the Bandera area.

**Spattercone Valley Trail.** This 1.3-mile trail, which is rich in volcanic features, will begin from the Ice Cave trail a short distance from the trading post. An orientation/safety wayside exhibit with a self-guiding interpretive publication covering the Spattercone Valley trail and the connector trail to Cerro Bandera (described below) will be provided at trailheads and at the trading post to ensure that visitors are prepared for the experience. Visitors should be aware that walking is difficult on this tortuous up-and-down volcanic terrain. The Spattercone Valley trail will cross one of the more jagged lava flows in El Malpais, and visitors should feel secure about where they are on the trail. The visitor experience will be like walking on the moon or being lost in a sea of lava. Spattercone Valley will be the primary

destination, where visitors will see several large spattercones, including the 40-foot-high Exquisite Cone. Although the self-guiding publication will answer a few of the obvious questions about how these features were formed, it will also convey a broader ecological message of how plants, animals, and humans have adapted to this most unusual landscape. Features that may be considered for interpretation include Hidden, Lava Bubble, and Picture Window sinks; Indian Water collapse and ice cave; and Perfect Circle, Little Rattler, and Hanging Fern collapses.

From Exquisite Cone, visitors will return on the same trail or continue on to the intersection of the Sandstone Ridge connector trail. From there visitors can take a .8-mile trail to Sandstone Ridge or go back to the trading post on the 1.1-mile Spattercone Valley connector trail that parallels the tour road.

**Cerro Bandera Connector Trail.** This 1.1-mile trail will connect the Ice Cave with the trailhead to the Cerro Bandera summit trail. An orientation/safety wayside with a self-guiding interpretive trail publication will be provided at the beginning of the trail to ensure that visitors are prepared for the experience. The publication (which also covers the Spattercone Valley trail) will interpret the surface lava tubes along the connector trail to Cerro Bandera, as well as other cultural and natural features. (Vehicular access to the parking area and trailhead and the trail to Cerro Bandera summit are described below under the East Rendija area.)

## East Rendija Area

A gravel road will provide vehicular access from NM 53 to the East Rendija area trailhead (see East Rendija Area DCP). Prior to reaching the East Rendija trailhead, access to the Cerro Bandera trailhead will be provided by way of a short spur road. The steep 1-mile Cerro Bandera trail will take visitors to the highest point in the national monument. From this commanding view, visitors can see hundreds of square miles of the El Malpais region, including the Zuni Uplift, Mt. Taylor, the breached cone and massive flow from Bandera Crater, the historic trading post complex, Sandstone Bluffs, McCartys Valley, Cerro Rendija, the Chain of Craters cinder cones, the Sawtooth Mountains, Cebollita Mesa, and the sandstone cliffs near Ramah. Wayside exhibit panels will be used

only at the summit. One exhibit will present a geologic perspective by identifying the most prominent geographic features and placing them in context with the regional volcanic story. Another exhibit will use the “world view” of other cultures to portray the same geographic features in the context of symbolism or legend (in consultation with local Indian groups).

The Cerro Bandera parking area/trailhead may also be a stop along the Continental Divide National Recreation Trail,” with access to the Chain of Craters and other points south in the national conservation area.

Visitors on the new road will also be encouraged to stop at the roadside pulloff at the lava wall trailhead before reaching East Rendija. An orientation/safety wayside will prepare visitors for the experience. A short loop trail will begin at the parking lot and skirt the edge of this impressive 70-foot wall of lava. A self-guiding interpretive trail publication for the East Rendija area, including the lava wall, will be available at the trailhead and include some of the basic information about the flow’s origin, age, boundaries, composition, and dimensions. The contrast of vegetation on and adjacent to the lava will also be discussed.

The East Rendija trailhead will be the final stop for visitors on the new road. An orientation/safety wayside and a self-guiding interpretive publication at the trailhead will ensure that visitors are prepared for the experience. The publication will interpret cultural and natural features along the trail, but will focus on two of the monument’s most spectacular lava tubes – Four-Window and Big Skylight caves.

Inside Four-Window Cave visitors will see the darkness being penetrated by light from above. This cave is over 900 feet long and has about a **50-foot** ceiling with four skylights. The first portion of the cave trail will cross a rugged lava floor surrounded by jagged lava walls. In contrast, the middle portion has smooth walls and flat floors that twist and wind like a subway tunnel for 400 feet. The view back to the mouth of the cave and to the skylights is unforgettable. Visitors can look through these four openings for a dramatic view of the sky, clouds, and overhanging trees. An equally

spectacular encounter of the stacked tube system lies ahead for those who care to venture even farther into this cave. The publication for East Rendija will interpret these interesting features, but for many the cave may be more of an inspirational experience. Imagination and interpretation may combine to make visitors wonder how other cultures may have viewed these natural phenomena.

Big Skylight Cave, which will also be entered by a trail, has a 30-foot circular skylight that allows an impressive view from below or from the trail above. This cave also has “bathtub” rings on the cave walls, which are associated with the falling levels of lava that flowed down the tube.

The trail to Four-Window and Big Skylight caves will offer various cultural and natural features to arouse the visitor’s interest. The self-guiding publication for East Rendija will also identify Caterpillar Collapse (a large winding collapse feature overwhelmed by streams of aa lava) and Seven Bridges (a long lava tube collapse where narrow spans of the former ceilings remain, forming seven natural bridges across the collapsed zone). Various types of prehistoric structures may be interpreted (with input from American Indians) to show the relationship between this lava terrain and the native people, both past and present.

### **Braided Cave**

The existing high-clearance primitive road will continue south from East Rendija to Braided Cave. A small dirt parking area, trailhead, and .4-mile primitive trail will provide the more adventuresome an opportunity to hike to one of the longer tubes in the monument. The crisscrossing system of rejoining tubes provides many opportunities for visitors to explore and discover for themselves. A self-guiding publication for East Rendija will also interpret the Braided Cave area, emphasizing those flows and features – such as the deposits of black sand within the tubes that are prominent in the Braided Cave area.

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11. The alignment of this trail has not yet been decided; it may also follow other trail alignments in the Bandera area.

## **El Calderon Area**

From a new parking area and trailhead along the improved access road in the area, a trail will lead to the entrance of Junction Cave. An orientation/safety wayside at the trailhead will prepare visitors for the cave experience, but visitors will be on their own to explore and discover. Junction Cave may receive a lot of use during the winter months when snow restricts access to Dripping Lava Cave and East Rendija.

Bat Cave will command most of the attention in the El Calderon area during summer months. Evening bat flights will continue to attract local residents and expected increases in regional and national visitors. A new .3-mile trail starting at a final new parking area will lead to a small informal viewing area set back from the mouth of the cave. An orientation/safety wayside at the trailhead will prepare visitors for the experience. Because the bat flights start at dusk, a well-defined trail will be required to ensure visitors a safe return to their cars. NPS regulations will prohibit entry into Bat Cave, and the layout and design of the trail and viewing area will also discourage cave entry. A wayside exhibit near the viewing area will use photography and/or artwork to give visitors a close-up image of these small creatures. The numbers of bats, what they do, where they go, and the role these lava caves play in their life cycle are questions that will be answered.

Explanations of the visitor health issues and possible damage to the bat population will also be provided to discourage visitors from entering the Bat Cave.

El Calderon is a dominant volcanic peak that is visible from the Bat Cave trail. A wayside exhibit will be used to interpret this cinder cone and its associated collapsed and intact tubes that wind for miles. El Caldron will also be identified as the source of older flows in this portion of the monument.

A second short trail, also starting at the new Bat Cave parking area, will lead visitors to Double Sinks. Visitors who use this trail may be surprised when two large circular holes (one about 30 feet across and one about 90 feet across, both 60 feet deep) appear unexpectedly in the earth's surface. These two collapse structures will provide startling evidence that molten lava once flowed here. A

wayside exhibit will be used to explain these two features and their microclimates. Lush ferns and mosses decorate the bottom of these two cavities. The abundance of such microclimates in this lava environment has created habitats for some of the 75 species of mosses and lichen that have been identified in the monument. The short trail between Double Sinks and Junction Cave will be a link between all three features and provide visitors with choices for short or longer hikes in the area.

## **Zuni-Acoma/Acoma-Zuni Trail**

The existing gravel entrance road will provide access to the west end of the trail from NM 53. The existing trail to a nearby trailhead overlook will be surfaced for wheelchair access. An orientation/safety wayside exhibit will be placed at the trailhead overlook. At the overlook visitors will visualize the general easterly direction of the trail across the flows. Another wayside will interpret the prehistoric rock structures near the overlook that served as bridges to span a small chasm.

A wayside exhibit will show how this trail relates to other early trails in the region, highlighting that portion of the trail that crosses El Malpais. Visitors should know something about the prehistoric and historic travelers who crossed this rugged badlands. Part of the wayside exhibit will touch on western expansion and the various expeditions that crossed or bypassed El Malpais in search of a better route west, including the **Dominquez-Escalante** expedition. A self-guiding publication for the Zuni-Acoma trail will provide a brief, general history of the trail. The publication will weave both the natural and cultural features found along the trail into a story of use that spans at least 1,000 years.

If an easement is acquired for the east end of the trail, a roadside pullout, small parking area, and trailhead will be provided adjacent to NM 117. A wayside exhibit and the same self-guiding publication just described will provide information for the east end of the trail.

## **Las Ventanas**

A 1.7-mile paved road from NM 117 will provide access to Sandstone Bluffs overlook. Once on this road, visitors will be able to take a short spur road

to the Las Ventanas trailhead/parking area. A wayside exhibit at the new trailhead/parking area will explain the importance of the entire prehistoric Chacoan culture system. A 1.3-mile trail will lead from the trailhead to a viewpoint on the ridge that looks down on a large natural sandstone arch and continues to the Las Ventanas Chacoan site. Spectacular views from this trail will generate numerous questions, some of which will be answered at the arch viewpoint through a wayside exhibit. More importantly, this view is inspiring and suggests the significance this landscape plays in the lives of American Indians, both past and present.

The trail will continue to Las Ventanas where visitors will see the physical remains of a community that thrived sometime between A.D. 1050 and 1200. The preferred alternative includes the option of removing the backfill from previous archeological excavation and stabilizing the exposed circular outline of the tower kiva for viewing by visitors. A wayside exhibit will identify Las Ventanas as a Chacoan outlier, placing it in context with both Chaco Canyon and the other Chaco outliers (more than 70) in the region (American Indian consultation will be sought for the wayside exhibit). The functions served by these visible structures (roomblocks and the tower kiva and great kiva) will be interpreted using artwork to create a picture of everyday life in this community.

### **Sandstone Bluffs Overlook**

The next stop for most visitors will be Sandstone Bluffs overlook. There will be parking and a short wheelchair-accessible trail to a viewpoint near the rim so visitors can see the landscape and lava from horizon to horizon. This trail and viewpoint will be designed to enhance and not detract from the overlook experience.

This overlook provides the best panorama of El Malpais, reveals near and distant patterns of an immense lava field, and provides opportunities to interpret a long continuum of human occupancy. Wayside exhibit panels will interpret the McCartys flow as a wide, 35-mile-long stretch of lava that is generally unweathered, uneroded, and barren. One exhibit will identify a few of the more prominent features – such as massive plates of pahoehoe lava turned on end, large pressure ridges, the small crater that was the source of the lava flow, the

Chain of Craters, and the Zuni Mountains – presenting a few facts about each. With consultation with the American Indians, an adjacent wayside will contrast this more scientific presentation with an alternative view of how other cultures perceive the creation of this landscape.

### **The Narrows**

From the roadside pullout and trailhead along NM 117 a .4-mile loop trail will provide the only opportunity along the NM 117 corridor for visitors to experience the spectacular features of the McCartys lava flow firsthand. The first short section of the trail will be wheelchair accessible. An orientation/safety wayside and a self-guiding interpretive publication will be provided at the trailhead to prepare visitors for this short hike onto the lava.

This visitor experience will be like standing in a vast field of freshly cooled lava. Large chunks of pahoehoe lava are chaotically pushed into each other along pressure ridges and in lava sinks. Looking back, visitors will see the dark lava against the light sandstone walls that contained this flow. A self-guiding trail publication will interpret the natural features, including lava squeeze-ups, pressure ridges, pahoehoe lava of different textures, dwarf vegetation, and an unusual stand of aspen.

### **McCartys Crater Viewpoint**

**Option 1.** If this option is chosen, a short paved spur road from NM 117 and small parking area will be constructed to a new trailhead. A .3-mile trail will lead to an interpretive overlook of the McCartys flow. From this point visitors will be able to look out across a great expanse of lava – the McCartys flow. The tiny crater that was the source of this massive lava flow is more visible here than at any other proposed development in the monument/conservation area. A wayside exhibit panel will interpret the flow from a geological perspective and then contrast it with Indian creation stories (to be interpreted in consultation with the American Indians). Another panel will interpret use of the crater as a bombing range. Visitors will also be interested in the geographic features that surround the lava-filled McCartys Valley. The orientation wayside near NM 117 will inform northbound visitors of the features ahead.

**Option 2.** There will be no development at McCartys viewpoint.

### **Roadside Kiosk Along NM 117**

If option 2 is selected for McCartys Crater viewpoint, a pullout, small parking area, and orientation kiosk will be constructed on NM 117 near the south monument/conservation area boundary. A wayside exhibit will be incorporated into the design to provide orientation, information, and a map with major points of interest. The wayside exhibit will also highlight the resources.

### **Visitor Use Monitoring**

There is very little specific information about visitor use of the monument. These data are important for efficient and effective management. To determine levels and patterns of visitor use throughout the monument, the Park Service will establish a monitoring system that will provide accurate collection of visitor use data at all developed visitor facilities and will allow for the timely evaluation and reporting of use statistics. In addition, a parallel monitoring system will be devised to estimate levels and patterns of backcountry use. These monitoring systems will be implemented as soon as possible and will be expanded and adapted as necessary.

### **Recreational Activities**

The Bandera visitor center, the scenic overlook pulloffs, and the cultural and natural feature pulloffs along NM 117 and NM 53 are included in the frontcountry. The Bandera Crater area will be the primary destination for most monument visitors. The multiagency center, the Bandera visitor center, and the trails to the Ice Cave, Bandera Crater, and Dripping Lava Cave will dominate the visitor experience for those who stay four hours or less.

First-time or repeat visitors who plan to spend one or more full days in the monument will travel more widely and visit more sites. In addition to the multiagency center and the Bandera visitor center, the East Rendija area, Sandstone Bluffs overlook, and the Las Ventanas Chacoan site will most likely attract visitors who choose to stay longer than half a day.

Recreational activities will include sight-seeing (vehicular touring), interpretive activities, hiking, spelunking, bird-watching, backpacking, backcountry camping, vehicular camping, and four-wheel driving. Specific backcountry hiking and backpacking opportunities will be specified in a future backcountry management plan. A brief description of the expected visitor experience relative to the standard of access and interpretation in each subzone is in the earlier section on management zoning.

**Backcountry, Nonmotorized Recreation.** A small number of visitors (less than 5 percent) will use the primitive subzone (approximately 109,275 acres), where they can hike cross-country or on primitive trails. Caving will occur on a permit-controlled basis. There will be no facilities and no on-site interpretation, and the emphasis will be on learning independently. Encounters with others will be infrequent or nonexistent, giving visitors the perception of a high degree of self-reliance and the greatest opportunity for solitude.

**Backcountry, Motorized Recreation.** A small number of visitors will use high-clearance or four-wheel drive vehicles along specified corridors in the semi-primitive subzone (approximately 3,988 acres) where they can access more remote areas within the monument/conservation area. There will be no facilities and little on-site interpretation. A low frequency of encounters with others will give visitors the perception of self-reliance and opportunities for solitude. Access to Braided Cave (in the monument) and Cerro Encierro and Cerritos de Jaspe (in the conservation area) fall within this category.

**Frontcountry Sight-seeing.** Most visitors will exclusively use the monument development zone (including the developed and rustic subzones and containing approximately 1,260 acres), where they can easily and quickly reach many of the monument's outstanding features by way of paved and gravel roads. Use will be encouraged by facilities such as visitor centers, scenic overlooks, a campground, restrooms and vault toilets, picnic tables, and a variety of interpretive stops and trails. Films, exhibits, demonstrations, and interpretive publications will be available at the two visitor centers. There will be on-site exhibits and publications at the major natural and cultural features, and guided interpretive activities will be offered. There will be a moderate to high frequency

of encounters with other visitors in the frontcountry. Despite the frequency of encounters, some of the trails may provide opportunities for solitude. The high levels of development and interpretive services will require a relatively low level of self-reliance.

## THE PLAN FOR CULTURAL RESOURCES MANAGEMENT

### Introduction

It is the Park Service's responsibility to locate and evaluate the significance of the natural and cultural resources in the monument and to provide resource-sensitive management, scientific study, preservation, and interpretation. El Malpais is a new unit of the national park system that contains numerous and complex cultural resources. Because it is a new area, there are major deficiencies in resource inventories, research data, and interpretive information as well as specific directions to deal with numerous other important problems. The Park Service must find ways to keep these resources unimpaired for future generations and provide for American Indian traditional use while managing the resources for the enjoyment of all visitors.

The following plan identifies the major cultural resource issues at El Malpais and recommends future studies and research.<sup>12</sup> It is designed to provide managers and cultural resource specialists with long-term, general guidance and a framework from which to make decisions regarding these resources. Guidelines need to allow El Malpais managers discretion in reaching decisions that reflect American Indian preferences while remaining in accord with the law; therefore, only general actions are proposed in this plan. Because of the lack of data, this plan is interim in nature.

Consistent with NPS procedure, a detailed resources management plan (RMP) will be written in the future. Because the cultural and natural resources at El Malpais are inseparable, these resources will be integrated in this detailed RMP.

The RMP will be based on expanded resource knowledge and increased experience with the resources. Specific project statements for the monument's RMP can be abstracted directly from the present document. The future RMP will also prioritize necessary projects and management actions so they can be accomplished in an orderly sequence. The RMP will further define the issues, describe ongoing operations and special projects, state costs and personnel needs, and describe the alternatives and their impacts.

### An Overview of This Plan

The cultural resources in El Malpais are of two types, which need to be managed in different ways. The first of these, the prehistoric and historic resources, are nonrenewable. The Park Service has a long history of dealing with these resources and has developed guidelines and policies for their management (which are described later in this plan and in appendix H). According to these guidelines and policies, the Park Service must prescribe specifically how the prehistoric and historic resources are to be managed at El Malpais.

The second type of resource is related to traditional human use. The establishing legislation for El Malpais specifically ensures that Indian peoples have nonexclusive access to monument and conservation area lands for traditional cultural and religious purposes. American Indians whose lands surround El Malpais have a long and deeply felt attachment to this special area. The lava flows and the hills and mountains are part of their creation stories and world view, and American Indian religious and subsistence activities are inseparable from this harsh and beautiful landscape. The significance of this cultural landscape<sup>13</sup> comes from past and present human interaction with and use of the total natural environment. However, these concepts are less familiar to NPS personnel, and there are few guidelines for management. Sensitivity is called for in the ways the Park Service manages the cultural landscape and affects the lives and practices of American Indians.

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12. A cultural resources management plan often includes a discussion of the environmental resources setting; in this document, this information is in the "Affected Environment" section.

13. A more thorough discussion of a cultural landscape appears later in this plan.

The Park Service will consult with local Indian peoples to develop mutually acceptable ways to enhance their privacy during religious activities, facilitate their gathering and other subsistence activities, and build a sense of shared responsibility for protection of religious and archeological sites. Ownership of land in legal title by the federal government does not mean that El Malpais does not also belong to Indians in a special “usership” and religious sense. It is inferred in the establishing legislation, and other laws make it clear, that local American Indians are also guardians of El Malpais. Effective consultation between American Indians and NPS staff leading to improved trust is crucial to the future of the national monument and is a basic part of this plan.

### **The Foundation of the Plan – Laws, Guidelines, and Policies**

A number of laws, guidelines, and policies were considered during planning. NPS-28, the “Cultural Resources Management Guidelines” (hereafter referred to as NPS-28), provides basic direction for dealing with cultural resources. The laws and policies seek a balance between the needs of American Indians to use areas of the national park system for traditional activities and management of the resources held in trust for all Americans by the National Park Service. Summaries of the most important cultural resources laws, regulations, proclamations, orders, standards, guidelines, and policies applicable to El Malpais are included as appendix H.

### **The Cultural Landscape at El Malpais**

El Malpais National Monument may be described as a cultural landscape (specifically, it may be an ethnographic cultural landscape<sup>14</sup>) -that is, a geographic area containing both cultural and natural resources that is characterized by use by contemporary peoples, including religious ceremonies, subsistence hunting and gathering, and other traditional activities. (Because criteria that help define a cultural landscape are linked to

National Register of Historic Places determinations, El Malpais is actually considered a potential cultural landscape until the area(s) are accepted as national register properties.) The inventory and evaluation of the El Malpais landscape (preceding national register nomination) will confirm the type or types of cultural landscapes that exist in the national monument.

### **American Indian Perceptions and Use of the Cultural Landscape.**

Usually, the most conspicuous elements of a cultural landscape are the human-built and natural environments. At El Malpais, however, one of the most important elements is the special meaning that American Indians ascribe to the landforms, lava flows, plants, and animals. These features are valued by the American Indians as a type of reference point in their religious beliefs and form an inextricable part of their world view, permeating all facets of their culture. The special environment of El Malpais influences human perceptions as well as use of the land and its resources. For example, particular lava features play an important role in American Indian worship. Special plants may grow only in certain places in El Malpais. To take advantage of these scattered resources, American Indians have had to learn the locations and times of year each species should be harvested; they also know the necessary rituals for each place and resource. This special knowledge, evolving over centuries of experience, has been passed from generation to generation. Traditional cultures have a long and enduring relationship with the land and its resources, a relationship that contributes to their sense of place and links the prehistoric past with the ethnographic present.

Contemporary American Indian legends and stories describing the creation of El Malpais make it obvious that the landscape continues to be part of the cultural identity of these peoples. The El Malpais landscape clearly reflects this identity and can come alive to almost anyone who begins to see “it is the human caring about a place that determines its vitality” (NPS Gilbert 1985b, i).

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14. There are five kinds of cultural landscapes (not mutually exclusive) – historic scene, historic site, historic designed landscape, historic vernacular landscape, and ethnographic landscape. Definitions can be found in NPS-28, appendix A.

Other groups, such as the Hispanics and ranchers, should not be overlooked in portraying the cultural landscape at El Malpais. Their perceptions reflect culturally diverse views, values, and resource uses that are important to the definition of the cultural landscape.

**Changes in the Cultural Landscape.** Natural forces continue to shape the landscape, yet El Malpais has retained its essential qualities of immense space, open vistas, and stark contrasts – especially the contrast of black lava rock spreading out below colorful sandstone cliffs and cinder craters.

The landscape has also been altered by humans through occupation and use of the environment. However, other than the roadways skirting the lava flows around the monument's boundaries, few man-made features are obvious to the casual observer. Close examination reveals trails through the lava that link special places for American Indians. Colorful pot sherds and fragments of chipped stone in quiet recesses mark thousands of years of history. Weathered cabins and sagging barbed-wire fences of the historic era also link the land to its past, continuing the human story at El Malpais.

**How the Cultural Landscape Will Be Delineated.** A future study for El Malpais will specifically define its cultural landscape. This will require the skill and insight of a number of specialists such as park managers, landscape architects, ecologists, historical architects, archeologists, cultural anthropologists and geographers, and representatives of the several cultures to whom El Malpais is important.

Research into the unknowns about this cultural landscape will result in information that is useful to managers. Historical and ethnographic research will first determine who used and still uses the landscape, how it was used, and what the landmarks and boundaries of the landscape may be. This study will help relate visible features and cultural traditions in time and space. In part, ethnographic data collection and research in the monument will be guided by and a component of the cultural landscape study. Archeological investigations will further define boundaries describe resources, and help refine the historic and prehistoric themes and contexts associated with El Malpais' cultural landscape.

Identification of human use patterns and architectural design (including the vernacular) will be a part of the process. The presence and impacts of monument visitors will also be considered. The identification of natural features will be especially important, because the landforms and distribution of water, vegetation, and animals heavily influence human use. Data on the natural and cultural features will help in understanding the condition of all the resources and help delineate the landscape. The cultural landscape study will also evaluate the landscape and its resources for national register purposes, and nomination(s) will be prepared as applicable. In this study, none of the types of resources –cultural, ethnographic, or natural – should assume primacy; instead, the study will be a holistic, synergistic product.

In recognition of the significance of this cultural landscape to contemporary American Indian groups, and to heighten awareness among other monument users, Indian names will also be used to identify landmarks wherever appropriate. Naming will be part of a cooperative effort with American Indians so that approved common tribal names are used for these features; special consideration may be needed for features named by more than one tribe.

Guided by the cultural landscape study, managers may prescribe additional actions, including scientific research, stabilization and/or preservation of significant resources, specific protection strategies, and interpretation. The landscape study should have high priority for completion to guide management decisions, especially those related to development and concerns of the Indians.

### **Protecting American Indian Religious Freedom**

The American Indian Religious Freedom Act provides for the preservation of Indian rights to practice their traditional beliefs; it also provides for consultation with Indian groups in planning and management activities that affect them. To fully comply with this act, the basic tenets of American Indian religions must be understood. For example, American Indian groups usually do not make a distinction between the secular and the sacred. Their religion is an inextricable part of their lives, integrated into all other traditional aspects of their culture. Places of worship and veneration may be natural features – mountains, springs, and lava

flows. American Indian religious practices are usually the secret and exclusive province of a particular practitioner and are shared only in prescribed ways with certain specified individuals having particular relationships with the practitioner.<sup>15</sup> Holders of traditional Indian beliefs may even feel that misfortune may come to those who share this information with inappropriate parties. Even knowledge that is not considered secret is likely to be private to the native community. Elderly tribal practitioners may hesitate to speak because they are not well acquainted with the English language, or they may remember past legacies of reprisal for traditional religious practices.

The Park Service will develop and accomplish its programs in a way that reflects respect for the religious beliefs, traditions, and other cultural values of the Indian tribes who have ancestral ties to El Malpais and its resources. The Park Service will strive to ensure privacy for American Indians to pursue their religious activities without interference or inappropriate observation by curious visitors who want to learn of Indians' special ways. This will be accomplished by designation of some public use areas as day-use only and by short-term to permanent closure of specified portions of the monument to the general public. The establishing legislation for El Malpais states that the governor of the Pueblo of Acoma and the chief executive officers of other Indian tribes should make recommendations on methods of ensuring access, enhancing the privacy of traditional cultural and religious activities in the monument, and protecting traditional cultural and religious sites (Public Law 100-225, title V, section 507). It is generally the custom of the Park Service to honor the wishes of American Indians regarding religious activities. NPS training programs will cover the etiquette to be followed when NPS personnel encounter religious activities or religious sites and offerings.

### **Subsistence Uses at El Malpais**

Traditional use in the monument is not currently perceived as a major problem by the Park Service. The El Malpais cultural landscape is the product of centuries of traditional use by American Indians and

others. The existing condition of these lands and resources represents a balance achieved through long interaction between humans and the environment. Continuation of the present low level of use poses no additional significant threat to resources. In fact provision for continued traditional patterns of use will probably help maintain the cultural landscape.

### **Trespass**

Visitors may accidentally enter Indian lands while exploring monument lands and unthinkingly intrude upon private religious activities, remove objects of religious significance, or trespass on lands used for grazing and other purposes. Measures to prevent these problems will include signs, fencing, interpretive pamphlets and messages in visitor centers, and routine ranger patrols.

### **Improving Communication Between American Indians and the Park Service**

Federal managers sometimes lack a good working knowledge of the etiquette to observe in talking with Indians. Ignorance of this etiquette may unintentionally offend tribal members and lead to poor communication. For example, managers should not assume that a lack of response from Indian tribes regarding federal proposals indicates no objection to or no interest in the project. The opposite is often true. Because of the egalitarian nature of the decision-making process in some tribes, the opinions of the entire group are sought and weighed before any decision is made. For groups like the Navajo, who live in dispersed homes scattered across large land areas, this means a lengthy process of notification and consultation. Religious matters may be referred to tribal religious leaders, a process which often cannot be accomplished within the short time frames imposed by planning. Meetings should be designed so that location, etiquette, and subjects are meaningful to the groups involved.

Because of good opportunities for a shared approach in identifying the cultural values that will

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15. Adapted from Advisory Council on Historic Preservation's "Draft Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review," August 1, 1985. p.9.

make El Malpais special to visitors, it is especially important for Indian/government interactions to be effective. Communications with American Indians will be routine and forthright, and Indian interests will be given the fullest possible consideration by the Park Service.

Indian tribes differ in their concerns and their feelings about sharing information on subsistence and religious activities, or the treatment of human burials and sacred artifacts. For this reason, the research studies described above and itemized in appendix I will be conducted by qualified professionals who are attentive to concerns of the American Indians. In addition, the Park Service will work with the concerned American Indian groups to develop sensitivity training programs for monument employees and volunteers.<sup>16</sup> Consultation with American Indian groups begun as part of the general management plan planning process will continue in the future, helping to improve understanding and achieve common goals.

## **Research, Documentation, and Evaluation of Cultural Resources**

The cultural resources of El Malpais National Monument include sites, objects, and structures ranging in age from the present to as much as 10,000 years ago, each with differing levels of significance, integrity, and need for protection. A brief description of the types of sites and their significance, condition, and use is found in the "Affected Environment" section.

**Prehistoric and Historic Resources.** Primary among the cultural resource issues at El Malpais is the lack of knowledge about these resources. Much of the past survey work was limited to small areas and was biased or inaccurate. Past surveys have covered only about 1.3 percent of the monument, and most of these surveys have been in areas away from the lava – adjacent to roadways and along the eastern boundary of the monument. Many surveys have been conducted to obtain compliance

for development and have not focused on scientific research. Only a few formal site-specific archeological excavations have been conducted. Many of these have been in areas where large prehistoric structures are visible, an approach that omits whole classes of sites and gives an unbalanced, inaccurate picture of the monument's cultural resource base. Much of the data is also old and was accumulated before modern dating technologies.

In turn, these data insufficiencies preclude efficient management decisions and severely limit prescriptions for treatment and preservation at this time. The lack of knowledge about area resources and their significance does not allow proper comparison of the importance and condition of one site relative to another. It also does not allow assessment of the place El Malpais resources occupy in a larger regional perspective; decisions about which sites to inventory and preserve untouched for future scientific research; and decisions about land acquisition priorities. Without knowledge about the location, significance, and integrity of sites, including the extent of deterioration, the monument staff cannot provide optimal protection and establish priorities for expenditure of time and money. Because there are numerous cultural sites in the few areas of the monument that have been surveyed, the Park Service expects to find many additional sites through future surveys.

Various plans and studies necessary to guide identification, study, treatment, interpretation, use, preservation, and management of the monument's cultural resources are outlined in appendix I. An integrated resources management plan will have high priority. Other plans needed include a research plan (as described in appendix J) to generate and express the rationale behind proposed future scientific inquiry, and an archeological overview and assessment to review, summarize, and evaluate existing archeological data. An archeological evaluation study is needed to determine eligibility of known properties for the

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16. An excellent start has been made in sensitivity training through the efforts of the Ramah Navajo. Also, an informal nonfunded Native American Consultation Committee has been established to improve communication among native Americans who are culturally linked to El Malpais, the National Park Service, and the Bureau of Land Management. This committee will meet periodically in the Grants area to discuss issues and concerns that may affect the preservation and interpretation of native American cultural heritage as well as NPS/BLM operational planning for El Malpais.

National Register of Historic Places. Combined archeological identification and evaluation studies will help define the cultural landscape at El Malpais and, on a long-term basis, will identify and help protect archeological sites. Cultural resource surveys will be synchronized with the natural resource surveys to take advantage of a broad range of professional disciplines and delineate the associations between the two types of resources wherever possible. Other plans and studies needed to guide resource management and potential development are itemized in appendix I. NPS-28 guidelines will be followed in developing standardized information about archeological sites, and information will be in a format that will integrate easily into state-of-the-art data bases (such as the one developed by the Museum of New Mexico's Laboratory of Anthropology). Data regarding the cultural context and location of cultural resources will be withheld from public disclosure according to law.

Archeological investigation, data recovery, and protection can benefit American Indians by preserving elements of their past history and culture and identifying their associations with prehistoric cultures. American Indians, however, may view archeological investigations of prehistoric sites as desecration rather than scientific inquiry. On the other hand, the Park Service has a legal responsibility to be accountable for archeological and other artifactual materials, a responsibility that cannot be arbitrarily dismissed. To effectively manage, the Park Service is also legally responsible to inventory cultural resources and evaluate their national register significance – it is virtually impossible to protect an unknown cultural resource.

Consultation with concerned local American Indians will precede archeological work, and all possible measures will be taken to resolve differences between Indian tribes and federal managers reasonably so that NPS plans and actions respect the cultural context of sites, including those that are ethnographic. Involving American Indians through consultation can help build trust. The Navajo and Zuni tribes have had successful archeological programs in which archeologists and American

Indians worked together to document sites. The U.S. Forest Service has helped develop para-archeology programs involving American Indians. Similar programs may be effective at El Malpais. American Indians can also play important roles as volunteers in observing and reporting evidences of pot-hunting, vandalism, and disturbance of sacred places. Communication about illegal activities will alert managers to the need for stronger or different protection measures.

Burials and sacred objects will be afforded the utmost respect, and the Park Service will consult with American Indians concerning remains associated with these groups (NPS Management *Policies* 5:13). El Malpais managers will establish a prompt and effective notification system to contact and consult with concerned groups. Some of the Indian tribes who traditionally use El Malpais have developed different policies for dealing with the exhumation, study, and reburial of human remains, and federal managers will deal with burials on a case-by-case basis, with an informed awareness of tribal concerns and following procedures outlined in NPS-28 (Technical Supplement 7) and in the NPS Management *Policies* (5: 13).

There is no easy way to determine when prehistoric sites and artifacts with long human use continuing to the present time are to be treated under the American Indian Religious Freedom Act, when these materials should more properly be handled as archeological materials subject to the Archeological Resources Protection Act and the related legislation, or when all these guidelines should apply. Therefore, discovery of significant cultural resources will be followed by protective measures. The Park Service will ensure that proper care and respect are accorded any sacred sites or objects encountered by consulting with American Indian groups who have an interest in these resources.<sup>17</sup>

**Ethnographic Research and Data.** The Park Service needs ethnographic information to manage El Malpais effectively and with regard for American Indians. Because much of the available data is out of date and incomplete, it is inadequate for describing contemporary peoples.

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17. Human burials and grave goods are also discussed in "Managing the Collections" section of this plan for cultural resource management.

There is no real consensus among American Indians regarding the need for ethnographic research. Some tribes recognize that such research can enrich their own historical knowledge and serve to record and hold onto traditional practices and beliefs that are being lost from their culture. Other American Indians find such research an intrusion into their privacy. To help allay this situation, American Indians will have access to the ethnographic information about them, and ongoing consultation will ensure accuracy, respect for American Indian culture, and relevance to the cultural practices that American Indians feel must be protected.

Plans are underway by the Bureau of Land Management to continue the ethnographic program begun with Holmes' assessment of the existing literature (1989). NPS studies needed include a traditional use study (done in correlation with the cultural landscape study) and an ethnographic resources inventory. The traditional use study is especially important with regard to development of the monument's fire and vegetation management plans because vegetation clearing, wildland fires<sup>18</sup>, and reclaiming and revegetating areas could alter the numbers, types, and distribution of plants or other natural resources traditionally gathered by American Indians. The Park Service will consult with American Indians regarding these concerns, and timely completion of a traditional use study will help guide development of future natural resources plans.

An ethnographic resources inventory, identifying areas of special cultural value to American Indians, is important to development of the cultural landscape study. This inventory, identifying areas of special cultural value to American Indians, will be accomplished to the extent possible, in accord with local Indian values and as they are willing to share information. However, it should be recognized that a complete inventory is not realistically anticipated. Sites having traditional cultural values may be only a location where American Indian religious

practitioners have gone historically and still go to perform ceremonial activities, leaving little trace upon the land; locations may be known solely from ethnographic research. Groups may be reluctant to reveal information that might jeopardize the privacy and effectiveness of their religious or subsistence activities.

In addition, El Malpais establishing legislation provides for protection of the privacy of traditional cultural and religious activities in the monument, consistent with the American Indian Religious Freedom Act. In keeping with the spirit of these laws, some ethnographic resources related to contemporary traditional practices in El Malpais will not be inventoried beyond the minimum level necessary for management. NPS regulations and policy require that archeological, ethnographic, historical, and other studies of this nature reflect sensitivity to the privacy of community consultants regarding practices, beliefs, and identities. It will also be monument policy that information regarding the location, nature, and cultural context of archeological, historic, and ethnographic resources be exempted from public disclosure (NPS *Management Policies* 5: 12, 13).

The Park Service may wish to provide technical assistance to American Indians who would like to record and interpret their own cultural history or be represented in the interpretive programs of the monument. Cooperative ventures with tribes to have them produce up-to-date ethnographic data on the uses of plants and other resources have been successful in other areas. By serving as interpreters, local American Indians could contribute valuable perspectives to the interpretive program. The monument staff will work with the NPS Harpers Ferry Center to evolve appropriate media for the interpretive story.<sup>19</sup>

**Evaluation and Compliance.** Because prehistoric, ethnohistoric, and traditional cultural sites are considered potentially significant for listing on the national register until they are evaluated,

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18. See definition of wildland fire in the "Plan for Natural Resource and Wildlife Management" section.

19. See the "interpretation" section of this cultural resources plan and the "Visitor Services/Interpretation Plan" section of the document for further discussion of proactive ideas regarding development of ethnographically sensitive interpretation.

development activities will avoid identified cultural resources whenever possible. American Indians will also be consulted when ethnographic or cultural properties of interest to them are involved.

As surveys and evaluations of significance proceed in the years ahead, national register of historic place nomination forms will be prepared.<sup>20</sup> Where strong American Indian concerns make formal nominations of religious sites to the register impracticable, minimal data necessary for site protection will be maintained in secrecy. Results of evaluations will also guide decisions regarding suitability of sites for research, interpretation, and special treatment or protection. Completed history and archeological reports will help document compliance activities and assist later research.

National register properties will have the highest priority for protection and will receive preservation maintenance. Resources identified as a component of the larger cultural landscape will be managed in this broader context.

A List of Classified Structures has not yet been prepared for El Malpais, but will be as soon as practicable. No potentially historic property will be inalterably changed without consultation with the New Mexico State Historic Preservation Office and the Advisory Council on Historic Preservation.

## Protection of Cultural Resources

The monument's cultural resources, including American Indian religious and subsistence sites, could be affected by various activities and other conditions. These include general "wear and tear" from concentrated use; site misuse, such as camping or picnicking on identified or unidentified sites; possible loss or destruction of historic fabric from adaptive use of historic structures; inadvertent disturbance of archeological sites from development and maintenance of facilities; vandalism and illegal collection of resources; and degradation by natural forces.

The El Malpais establishing legislation strongly emphasizes the preservation and long-term

scientific use of the area's cultural resources. This cannot be accomplished unless sites are protected from threats that would diminish their integrity. Loss of these resources at El Malpais degrades resource quality, destroys scientific information, and deprives visitors of important educational opportunities.

The following discussion proposes some general principles for protecting the monument's cultural resources. The future action plan, the RMP, will draw upon these principles in describing the actions and priorities for specific management projects.

**Natural Degradation of Sites.** Natural processes of wind, water, gravity, fire, expansion of plant roots into sites, and digging by animals have adverse impacts on cultural resources. Cultural and natural resource management will be integrated whenever possible to alleviate this problem; priority sites will be monitored and erosion control and other mitigating measures will be taken.

**Looting and Vandalism.** Destruction of finite, nonrenewable cultural resources that are important to the nation's heritage through looting and vandalism is endemic and epidemic in the United States, and it is occurring at an alarming rate. The government's costs for protecting these resources, in terms of personnel and money, is substantial.

While some visitors do not perceive casual collection of such things as pot sherds and projectile points as a major problem, such collecting is illegal and destroys scientific information. Detailed surface documentation, law enforcement, interpretation, and public education programs will be used to help mitigate these impacts of visitor use.

Because looting is a lucrative way of life for some people, it is important to consider that

Archeological looting and vandalism on public lands are types of illegal, anti-social behavior no different in their basic criminality than other forms of public property theft and defacement. Yet, we have tried to deal with them as if they were unique types of activities and

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<sup>20</sup>. Resources will be evaluated as outlined in 36 **Code of federal** Regulations 60. National register forms will be prepared in consultation with the concerned tribe.

not encompassed by the discipline of criminology (McAllister 1988, 53).

One solution to looting for gain seems to be swift, comprehensive, consistent law enforcement. Increased patrolling by law enforcement officers will be an important deterrent to looting and vandalism at El Malpais. In addition, a monitoring program will be established for sites and areas most vulnerable to human and natural damage. These monitoring and law enforcement programs will be reevaluated periodically to determine their effectiveness. If sites show degradation, additional protection measures will be adopted. Predictive modeling as already developed (Christensen et. al 1988, 62) will be used to help identify areas with special needs for resource protection until the monument's resource inventories can be completed. The model will identify factors that make sites accessible and visible, and the characteristics of the individuals most likely to vandalize or loot sites.

Information about recorded sites and their conditions will be compared to environmental data such as topography, soils, geologic features, and vegetation. The combined data about recorded and postulated sites, vulnerability factors, and environmental conditions will be analyzed to identify areas that may have sensitive resources. Such areas will receive high priority for patrol and archeological investigations, and monitoring programs will be established; the model will be tested against actual site conditions.

Agreements with private landowners, state and federal agencies, and Indian tribes will be sought to increase protection and monitoring capabilities. Law enforcement will be coordinated, and a cooperative law enforcement network will aid in stemming violations.

Archeological Resources Protection Act training courses will be held for all monument employees and volunteers (not just those involved in law enforcement). This training will improve understanding of the types of protected resources; outline successful prosecution methods; help develop new strategies for preventing crimes; and teach damage assessment reporting, case preparation, and ways to improve existing law enforcement efforts.

Informal names of certain shelters and caves in the monument's lava flows are descriptive of features

found there – “Ash Chamber Cave,” “Cairn Cave,” etc. Unfortunately these names tend to identify areas where cultural resources are or were once found, give the impression that such resources are present, and may increase vandalism. Care will be taken in the preparation of exhibits and publications to avoid this problem.

**Effects of Development.** Surveys of development areas will precede final comprehensive design so that construction will avoid known sites. However, construction of buildings campsites, sewage facilities, leachfields, parking areas, trailheads, trails, and roads could destroy unknown archeological resources. Construction activities will disturb and compact soils, which can alter the horizontal and vertical distribution of buried archeological remains, thereby damaging artifacts and the contextual environment of sites. Prior to any proposed earth-disturbing activities, a professional archeologist will inspect the ground surface for prehistoric or historic remains. If any previously unrecorded resources are found, additional investigations, data retrieval, and evaluation of significance will be completed and mitigations prescribed before actions begin. As questions about mitigating measures arise, they will be resolved in consultation among the Park Service, the Advisory Council, the New Mexico State Historic Preservation Office, and concerned American Indian tribes.

Archeologists will monitor construction in areas where subsurface remains are likely. Where feasible, trail and road alignments will be shifted to avoid archeological resources; otherwise, sampling/collecting/testing procedures will be followed. Priorities for archeological investigations will depend largely on the sequence of development, the amount of existing data, and the potential threat to significant sites; work will also relate to the research plan discussed in appendix I. However, Las Ventanas/Sandstone Bluffs and the Bandera Crater areas will be the top two priorities for intensive survey and documentation because of the high potential of additional sites in these areas.

Wherever feasible, existing historic structures will be adaptively reused in lieu of new construction as required by section 110 of the National Historic Preservation Act. Treatment of these structures will be guided by applicable NPS policies. To avoid improper structural modifications that may diminish the integrity and significance of historic structures

and sites, specific preservation plans for the monument (historic structures reports and preservation guides, research plans, etc.) will be developed and conform to the secretary of interior's standards for rehabilitation. These plans will help avoid the serious cumulative impacts that a series of small unrelated projects would have on the total resource over time.

Stabilization and maintenance of prehistoric structures will follow similar preservation standards. The physical properties of original building materials and construction techniques will be documented archeologically and/or architecturally prior to stabilization activities, and preservation plans and guides will be developed for their future care.

At all monument development areas, design will be compatible with the cultural landscape, respecting the original landform. American Indians will be consulted prior to design of roads, trails, and facilities throughout the monument, and their advice will also be sought on appropriate means of protection for important resources. The monument staff, in consultation with American Indian groups, will find solutions to potential conflicts between visitor use, trespass, and Indian traditional uses. Provision will be made to avoid construction and public use during primary periods of religious activity. Most religious use in the vicinity of **Bandera** Crater will likely occur in winter when there are few visitors. The superintendent and concerned American Indians will work out this closure and others to protect privacy.

Design of facilities will provide the highest feasible level of physical **access** for disabled persons consistent with the preservation of significant prehistoric, historic, and ethnographic attributes. Design and installation of facilities for handicap access will be in a manner that least affects historic qualities; if modifications would compromise significant historic fabric of the property, they will

not be made. Design will involve experts in both accessibility and historic preservation.

#### **Protecting Resources from the Effects of Use.**

Sites adjacent to facilities, roads, and trails may suffer secondary impacts from visitor use -that is, "wear and tear" from foot traffic and recreational activities. Intensive surveys and evaluations will be completed for areas likely to receive secondary impacts, and mitigations will be prescribed.

Protective measures such as restrictions on visitor access will be designed to reduce impacts on sites. Informal foot trails and vehicular ways that lead to sensitive archeological sites will be blocked and the tracks revegetated. Sites that have had extensive past disturbance may be backfilled to lessen their visibility. Ruins and historic structures will be stabilized as appropriate. Well-defined self-guiding trails and other such structured activities will discourage visitors from leaving designated areas and collecting or inadvertently disturbing the privacy of American Indians. The Park Service will use the permitting process to direct backcountry visitors to areas of particular interest while minimizing impacts on sensitive natural and cultural resources.

Numerous rock cairns (stone markers) have been put on the lava by pothunters, spelunkers, and others. Although some cairns mark contemporary routes, others are undoubtedly prehistoric, and some may be related to use by contemporary American Indians. Extreme care will be taken to protect and leave in place those cairns that mark prehistoric routes or features currently used by Indians.

Recent historic preservation legislation requires federal agencies to inform the public about the problems involved in protecting cultural resources. Public involvement and education programs will be developed at El Malpais to help visitors understand the science of archeology and the problems caused by looting. Public involvement will increase volunteer activity in resource protection, which has

been found to be the most effective means of dealing with hobbyists and casual collectors. Changing the attitudes that lead to theft and defacement is crucial. New attitudes eventually lead to extralegal sanctions, such as peer disapproval and stronger moral standards. Some existing programs may be used.<sup>21</sup> NPS managers will determine the most effective programs to accomplish the following goals:

- to foster a feeling of ownership and responsibility for our common heritage
- to increase public understanding of the science of archeology
- to enhance public awareness of the current threats to archeological resources
- to increase understanding of how the public's actions affect archeological resources
- to increase public involvement in legitimate archeological activities

## Managing the Collections

Museum objects and collections, study collections, archeological materials, natural resource specimens, exhibits, and interpretive items are essential to achieving the purposes of the monument, including scientific research, historic preservation, and interpretation and education. Besides natural and cultural objects, collections include field notes, photographs, oral histories, building plans, maps, archival records, letters, etc., dealing not only with history but with the disciplines of paleontology, geology, biology, anthropology, and archeology.

At present the monument has no formal collections, no collections storage, and no collections policy. Guidance for acquiring objects and documents that contribute directly to the understanding and

interpretation of the monument's themes will be provided by a scope of collections statement. An interim scope of collections statement consistent with the *NPS Management Policies* (4:4 and 5:10) and NPS-28 will be developed immediately by monument staff in consultation with the regional curator to guide accession policies until the final scope of collections statement can be completed. This interim policy will coordinate with BLM collections policies wherever feasible.

Guided by the scope of collections statements, the Park Service will acquire by purchase or donation relevant artifacts, photographs, field notes, oral histories, and other supporting data from various sources (including private interests and public institutions) to establish a baseline collection for exhibits and interpretation. For example, various items and furnishings that are currently part of the privately owned trading post at Bandera Crater are important to interpretation of the themes of volcanism, prehistory, and tourism and recreation and may be acquired.

It is important that items of historical or scientific interest be evaluated in their own right, not just acquired as part of a package collection or with other property acquisitions. Items determined to be significant and relevant to monument purposes will have high priority for acquisition. The Park Service will acquire only those collections with a legal and ethical pedigree, in accordance with existing laws and management policies (*NPS Management Policies*, 5:10).

Some artifacts from prehistoric sites currently used by American Indians for religious purposes may be considered by them to have special religious significance. American Indians may present a strong claim for some such items, arguing a long continuum of site use, especially at those sites they perceive as ancestral. However, because the Park Service has legal responsibilities to be accountable for the archeological artifacts from lands it manages, determination of responsibilities and

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21. The NPS Archeological Assistance Program, the NPS Listing of Education in Archeology Projects, state and local programs about protection of resources (including teacher training kits, special exhibits in public buildings, cultural design competitions, crafts shows, newsletters, and adopt-a-site and stewardship programs), and public involvement programs (where volunteers do anything from displays and programs to actual on-site and laboratory activities under the supervision of professional archeologists, architects, and historians) are among some of the choices management has. Informed volunteers become avid resource advocates and often contribute their own professional expertise, saving the Park Service appreciable amounts of money and resources.

treatment of these individual items will be handled on a case-by-case basis under NPS-28 and the NPS Management Policies. At the same time, it is important to continue to consult with American Indians, working out the most feasible approach to management of the resources that are significant to these contemporary peoples.

Requests for repatriation (return) of objects and materials to American Indian groups or individuals will also be handled on a case-by-case basis. The National Park Service will repatriate museum objects when lawful and when it can be demonstrated by a American Indian group that the materials are their inalienable communal property (NPS Management Policies 510).

A collections management plan will be developed to guide the management of monument collections. Accessioning, cataloging, and storing collections will follow this plan and the procedures outlined in NPS-28 and the *Museum Handbook, Parts I and II* (NPS 1984).

Future disposition of collections and objects will be guided by the NPS policies and guidelines mentioned above. Archeological materials will not be disposed of without consultation with and permission of the regional curator. Dissemination of information to the public or researchers regarding archeological and anthropological materials and other sensitive topics may occur only in accordance with policies governing release of confidential data (NPS Management Policies, 5:12 and 8:9).

Once the basic collections management documents have been developed for El Malpais, a concerted effort will be made to locate, inventory, and photograph artifacts and documents previously removed from El Malpais through archeological investigations or private collecting. Records from past surveys and archival materials held by public institutions should be microfilmed and added to the monument collection to assist managers, researchers, and interpreters.

The monument currently has no storage facilities for collections. Adequate space will be provided at monument administrative headquarters in Grants. An interim collections storage plan will be developed to guide this effort, and the plan will become part of the later collections management plan. Collections storage will be in agreement with NPS-28 (3:16), which requires that collections be

housed in secure and safe storage facilities that are not in the same room with incompatible activities or materials. This space will be of a suitable nature, spatially adequate, well organized, and environmentally safe and stable. Appropriate fire protection and physical security will also be provided.

The space leased in Grants is unlikely to meet all NPS standards for collections storage. Materials requiring special environmental controls will be transferred to the NPS Western Archeological and Conservation Center.

## Interpretation

The monument's interpretive programs will deal with natural and cultural resources themes specific to El Malpais, as described in the "Visitor Services/Interpretation Plan" section. Many visitors are deeply interested in the archeology, history, and ethnography of the Southwest, themes that are all relevant to El Malpais.

The unique constellation of landforms, plants, animals, and traditional human uses of El Malpais suggests that interpretative themes should present a holistic and integrated view of all these resources. This multidisciplinary approach to cultural resource research and interpretive exhibits and programs can result in exciting educational opportunities and experiences for visitors.

Cultural sites and structures vary widely in their visibility and attractiveness, and many are not particularly interpretable. Accessible sites that are appealing, highly visible, and have interesting stories will receive a high priority for research if they also have the potential to enrich interpretive programs.

Various ethnic groups may understand the meanings of different words in many different ways. In addition, there are different names for geographic features. American Indians are familiar with traditional names given to these features long ago and may not always recognize the current Spanish or Anglo names. Therefore, in pursuit of properly defining the cultural landscape, alternative traditional names for landmarks will be fully considered. This could make maps, exhibits, and interpretive programs more interesting to everyone.

Traditional arts and crafts may need to be acquired for interpretive exhibits, but NPS policies will be followed to ensure that no sacred objects like medicine bags, bundles, pipes, masks, and effigies will be acquired and displayed, and that other items are treated in an appropriate manner.<sup>22</sup>

NPS *Management Policies* provide for active consultation with concerned American Indian groups to plan, develop, and operate interpretive programs that relate to the history and culture of these groups. Indigenous groups, particularly American Indians, are one of the monument's most important cultural resources. Contributions of American Indian stories, poetry, traditions, and insights enrich and strengthen the interpretive story.

The interpretive programs must convey to the visitor a sensitive and respectful view of contemporary American Indians, Hispanics, and others whose lives are intimately connected with El Malpais. The Park Service will work with these groups in preparation of information and media. By serving as interpreters, local American Indians could contribute valuable perspectives to the interpretive program. Programs dealing with ethnographic topics will be as factual and balanced as possible. What is said to the public will be information only at levels acceptable to traditional Indian authorities and will be only information that contributes to better understanding of the Indian perspective about the El Malpais landscape. In addition, the monument staff will also work with the NPS Harpers Ferry Center to evolve appropriate media for the interpretive story.<sup>23</sup>

The *Final Joint Management Plan: Chaco Archeological Protection Site System* (NPS 1983b) identified Las Ventanas as an important outlier within the larger prehistoric Chacoan system and calls for a unified approach to interpretation of sites within the system. The monument staff should

involve themselves in the Interagency Management Group as a way to better understand the site and to coordinate interpretation with that presented at other major outliers.

## THE PLAN FOR NATURAL RESOURCE AND WILDLIFE MANAGEMENT

### Introduction

El Malpais National Monument is one of the newest additions to the national park system, and the status of many of its natural resources is uncertain. Although several studies have been conducted in the area, especially geologic studies, data about other natural resources are sparse. A resources management specialist has only recently been hired at the monument, and the development of a resource management program is only now beginning.

This initial or interim plan for managing the natural resources, as contained in this section, is required by the legislation that established the national monument/conservation area. The legislation also calls for a separate wildlife management plan, but because of the interrelationship of all natural resources, including wildlife, wildlife management proposals are incorporated into this interim plan rather than in a separate plan. In addition, consultation with the New Mexico Department of Game and Fish (NMDG&F) and the U.S. Fish and Wildlife Service (USFWS) has revealed no major monument wildlife issues. Consultation with the NMDG&F and the USFWS will continue on any future plans relating to monument wildlife.

This plan for managing natural resources will state preliminary natural resource objectives; address management status, issues, and needs based on a preliminary evaluation of available data; and

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22. "The National Park Service will not exhibit native American disinterred skeletal or mummified human remains or photographs or replicas of them. There will be no display of grave goods or other objects if native Americans who are culturally associated with them object to such exhibit. Associated native American tribes and groups will be consulted to determine the religious status of any object, the sacred nature of which is suspected but not confirmed, before it is exhibited or before any action is taken" (NPS Management **Policies**, 7:5).

23. See "Visitor Services/Interpretation Plan" section for further discussion of proactive ideas regarding development of ethnographically sensitive interpretation.

present interim actions that will be taken.<sup>24</sup> A future resources management plan (RMP), which includes natural and cultural components, will be written based on expanded resource knowledge as well as growth in management experience with the resources.

The EI Malpais legislation ensures access to American Indians for traditional religious and subsistence activities, including gathering of pinyon nuts. These concerns were addressed earlier in the cultural resource portion of this plan in the section on subsistence uses.

### Objectives for Managing EI Malpais' Natural Resources

Natural resource objectives, as specified in EI Malpais National Monument legislation are that

the Secretary [of the Interior] shall protect, manage, and administer the monument for the purpose of preserving the scenery and the natural . . . resources of the monument and providing for the public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

In support of legislative intent, the monument's interim natural resource management objectives, by management topics in priority order, include the following:

**Interpretation** - To develop and conduct natural resource interpretive programs that help preserve natural resources through public understanding and appreciation of natural ecosystems.

**Visitor Use** - To identify and regulate appropriate recreational uses such as hiking, caving, picnicking, and camping and to monitor all areas for effects of these activities based on ecosystem tolerance; to develop recreational facilities and provide backcountry

information and permits that are designed to limit resource impacts.

**Law Enforcement** - To protect the natural resources by providing trained personnel to enforce applicable laws and regulations; to establish cooperative agreements with other government organizations, local law enforcement agencies, and private landowners to assist in the protection of monument resources.

**Facility Development** - To develop facilities that are harmonious with and blend into the surrounding environment, using natural materials whenever possible; to avoid overdevelopment of facilities; to provide a monument collection facility for protection and storage of natural resource collections.

**Scientific Research** - To establish research programs that identify, evaluate, monitor, restore, and maintain/preserve natural resource values and ecological processes.

**Cooperative Planning** - To work with local, state, and federal agencies to assist in achieving mutual management goals and objectives.

### Natural and Wildlife Resource Status and Needs

**Lack of Information.** Baseline data on resources such as soils, flora, fauna, hydrology, air quality, and fire history are incomplete. Approximately 95 percent of the monument is lava terrain that is rugged, generally inaccessible by vehicles, and difficult to traverse on foot. Few inventories or research have been done because of these conditions. The Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Soil Conservation Service, state of New Mexico, University of New Mexico, and individuals such as ecologist Alton Lindsey have conducted various studies of the biota of the area, but most information is dated and limited in value for monument management purposes. (In contrast, studies of volcanic phenomena by geologists have

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24. Because information on the significance of the monument's natural resources can be found in the "Affected Environment" section of this general management plan, this information is not repeated here.

been extensive, and the highlights of these publications are summarized in the "Affected Environment" section of this document.)

As part of the planning process, current data have been collected and initial evaluations have begun. Recent inventories include a lava tube inventory (NPS Carlton 1988b) and a lava surface features inventory (NPS Carlton 1989a). A grazing management plan is being prepared by monument staff and the NPS Southwest Regional Office. Comprehensive vegetation and soils mapping, which includes the monument, is being performed by the Bureau of Land Management in conjunction with their planning process. The Soil Conservation Service is completing a comprehensive soils survey of Cibola County (including all of the monument).

However, much remains to be done. Large areas of the monument remain uninventoried. Additional data collection, research, and monitoring are needed to help identify the current condition of natural resources and immediate or potential threats before comprehensive protective measures are prescribed. The identification and documentation of the condition of all natural resources is essential to formulation of future management strategies to protect and preserve monument natural resources. Knowing the status of all natural resources will provide a baseline against which changes can be measured and appropriate management actions taken. Limited and incomplete data would make management decisions speculative, possibly resulting in mismanagement, including degradation or destruction of resources.

To remedy this critical deficiency, a more thorough inventory and evaluation of natural resources will be performed on a high priority basis. Quality copies of past reports, studies, and maps will be obtained. Information will be compiled and stored in an integrated and retrievable system for efficient use. Some ground-truthing and data adjustments may be necessary. Data will be made compatible by standardizing map scales, nomenclature, and other parameters. Additional inventories and studies relevant to management needs will be identified and initiated.

### **Reclamation/Revegetation of Damaged Areas.**

Several areas in the monument have been damaged from past and present resource exploitation. Affected sites include one active and two inactive cinder pits, a 25-acre earthen and lava rock borrow area, an abandoned sandstone quarry, and several miles of vehicular ways. Two of the cinder pits, the borrow pit, and the sandstone quarry are on private land within the monument boundary. The vehicular ways, several of which are on private land, historically provided access for timber and livestock operations and possibly hunting, but many no longer provide any legitimate use. Large scars resulting from human activities, some on steep slopes, are resulting in major erosion problems and are visual intrusions. These disturbed soils cause a proliferation of exotic vegetation and a loss of wildlife habitat. Vehicular ways are still occasionally used by monument visitors who believe they are designated roads, which they are not. Continued use, even occasional, results in continued degradation of resources. Natural restoration takes a long time because of compacted soils and continuing erosion on steep slopes.

To alleviate this damage, extensive reclamation/revegetation efforts will be undertaken. Restoring the cinder and borrow pits and some of the vehicular ways that are on private land would require federal acquisition of some properties. Ways not on private property and considered nonessential will be officially closed or their use restricted by gates or barriers.

**Air Quality Management.** The monument is designated a class II area under the 1977 Clean Air Act (42 U.S.C. 7401 et seq.). The act establishes maximum allowable increases beyond baseline concentrations of sulfur dioxide, particulate matter, and nitrogen oxides – increases that cannot be exceeded at a class II area.<sup>25</sup> Section 118 of the act requires the monument to comply with existing federal, regional, state, and local air pollution control laws and regulations.

Visibility/air quality is a primary monument resource. The air in Cibola County and El Malpais

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25. A national monument automatically becomes a class II area when established. However, it appears that the air quality at El Malpais may be worthy of a higher standard, and the Park Service would cooperate with the state to raise the standard if further studies show that a higher designation is warranted.

either meets or is better than the National Ambient Air Quality Standards (NAAQS) established for all criteria pollutants (sulfur dioxide, total suspended particulate matter, ozone, carbon monoxide, nitrogen oxides, and lead). Currently, El Malpais air quality appears to be excellent except for occasional short periods of regional haze. However, there is no monitoring within the monument, and no monument-specific determination of compliance with federal and state sulfur (SO<sub>2</sub>) and nitrogen (NO<sub>2</sub>) oxides, suspended particulates, or other air quality standards. There is insufficient data to determine soil, vegetation, and water quality conditions as they relate to air quality.

There are no major sources of air pollution in the immediate vicinity of the monument; however, there are major sources of pollution in the region that could impact the monument's air quality. These include coal-fired power plants at Thoreau, New Mexico (50 miles away, which burns about one million tons of coal per year), Farmington, New Mexico (125 miles away), and Holbrook, Arizona (175 miles away). Construction of a second 233 megawatt coal-fired power plant near Thoreau is being considered. The proposed Bisti coal-fired power plant, which would be about 85 miles north of El Malpais (near Chaco Culture National Historical Park), could also have an adverse impact on the monument's resources if it is constructed.

Mining, another potential source of pollution, is a major economic activity in western New Mexico. The El Malpais region contains several large coal fields, and increased energy development in the region could threaten existing air quality levels. The uranium mining and milling near Grants, a possible source of particulate matter, is essentially shut down. The nearest copper smelter is in Hurley, New Mexico, 165 miles southwest of the monument. Other smelters are in El Paso, Texas, southeastern Arizona, and northern Mexico.

Fossil-fuel combustion results in increased SO<sub>2</sub> and NO<sub>2</sub>. Concentrations of these pollutants are known to be harmful to a number of fragile plant species, some of which are found in the monument. These include Douglas fir, ponderosa pine, and lichens. The monument contains over 70 identified lichen species. Lichens, when moist, absorb gases over their entire surface and are extremely vulnerable to injury induced by elevated levels of SO<sub>2</sub>; as such, they can be used as bioindicators of ecosystem air pollution stress. In cryptogamic associations with

various algal species, lichens play a crucial role in the stability and health of arid shrub and grasslands such as those at El Malpais. A lichen study in 1984 found no indication that the lichen were being affected by pollutants at that time (DeBruin 1984).

To better protect the monument's air quality, including the atmospheric quality of viewsheds and the protection of the monument's flora and fauna, air quality data will be collected and documented. Monitoring and testing studies will be conducted to determine levels of gaseous pollutants, particulate matter, and acid deposition levels at El Malpais. The monument staff will work with the New Mexico Air Quality Bureau to ensure that all internal activities meet the requirements of the New Mexico State Air Pollution Control Implementation Plan (SIP) (40 CFR 52.1620 ff, approved July 1, 1988).

### **Management of the Monument's Visual Quality.**

The visual quality of the monument greatly influences the visitor's overall recreational, educational, and spiritual experiences. Landscapes and viewsheds both within and outside the monument are critical resources and contribute greatly to the aesthetic values of the monument. Key landforms within the monument, such as Sandstone Bluffs, Cerro Bandera, Bandera Crater, and others are described in the "Affected Environment" and "Visitor Services/Interpretation Plan" sections. Key landforms outside the monument that can be clearly seen from within the monument include Mt. Taylor (north – a shield volcano and the highest peak in the region), Chain of Craters (west), the Sawtooth Mountains (south), Mesa Negro and Cebollita Mesa highlands (east), and the Zuni Mountains (northwest). Another important aspect of the monument is the vast expanse of open volcanic badlands that give the visitor an appreciation for the extensive geological activity that took place in the area.

Management practices inside and outside the monument can affect visual quality. Impacts outside the monument include scars from mining and ranching operations, powerlines, and roads. Within the monument borrow and cinder pits, heavily grazed and timbered areas, roads, powerlines, and buildings also impact visual quality.

To mitigate visual impacts and prevent further impacts, the monument staff will work cooperatively with private landowners, local governments, federal agencies, and others. Also, the monument facilities

will be carefully designed -to harmonize with the surrounding landscape. Areas disturbed will be revegetated and restored to their natural appearance.

**Fire Management.** Only 20 years of fire data has been collected, and during this time there have been about 100 natural wildfires in and near the monument. Most have been small, less than 1 acre, but several large fires have occurred (10,266 acres in 1976, 40 acres in 1980, 400 acres in 1984, and 90 acres in 1988). Four fires in 1989 resulted in 6,500 acres burned. The effects of these fires on vegetative composition has not yet been evaluated.

El Malpais National Monument is developing a fire management plan (anticipated completion is early 1990). The current practice is total suppression, and this will continue until a plan to determine future actions is developed and approved by the Boise Interagency Fire Center. The plan will address management of wildfires and prescribed fires.

Past buildup of natural fuels due to full fire suppression policies require that the Park Service use hazard fuel reduction techniques to restore a natural balance.

Also needed is a fire ecology research program to provide information on fire history, ecological effects from past fires, fuel-load buildup areas, and other data. The importance of naturally caused (lightning) fires in maintaining biotic diversity is well recognized. A fire ecology research program would also determine prescriptions for specific wildland fire<sup>26</sup> management techniques that would assist with the comprehensive management of monument flora and fauna, prevent damage to cultural resources, and perpetuate natural ecosystems. A fire management plan that is compatible with BLM and USFS fire management practices will be developed in accordance with the "Final Report on Fire Management Policy" (U.S. Department of Agriculture/Department of the Interior 1989).

**Water Management.** In the monument's establishing legislation, Congress directed the Park Service to preserve the significant natural and cultural resources of the lava flow areas and manage them for the benefit and enjoyment of present and future generations. Preserving the natural resources includes the roles that naturally occurring water plays. As explained in the "Visitor Facility/Development Plan" section, attempts are being made to acquire these water rights.

**Boundary Survey and Identification/Marking.** El Malpais National Monument has approximately 130 miles of irregularly shaped boundary, which has not been officially surveyed or, in most areas, marked. (An official [legal] description of the boundary has recently been prepared and transmitted to Congress.) Without an official survey and clearly visible boundary markers, monument land could be mistaken for land outside. Adverse impacts may result – illegal woodcutting, hunting, poaching, and disputes with adjacent landowners. To adequately protect monument resources, the boundary will be surveyed, monumented, and marked/fenced.

**Backcountry/Wilderness Management.** Although the rugged backcountry lava areas seem undamageable, many fragile resources are present. As visitation grows so will the demand for backcountry use, and impacts to resources will likely result. Also, 83 percent of the monument appears suitable for wilderness designation and must be managed to protect wilderness qualities and values until Congress takes formal action (see "Wilderness Suitability Study" section of this document).

To manage the demand for recreation and assist in resource protection and backcountry search-and-rescues, a permit system has been established and is in use. The permit system ensures that backcountry users fully understand the regulations, requirements, and inherent backcountry dangers and aids in the protection of natural and cultural resources.

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26. According to the "Final Report on Fire Management Policy," there are two kinds of wildland fires – "prescribed fires and wildfires. Prescribed fires may be ignited by managers, or naturally occurring fires may be allowed to burn, under specified conditions to achieve established management objectives. Any other fire is considered a wildfire, and appropriate suppression action is taken on all wildfires."

A **backcountry/wilderness** management plan will be prepared to protect the primitive character of the terrain and will include provisions for managing use and protecting the resources. It will include continued use of the **backcountry/wilderness** permit system and establishment of a resource monitoring program. Standards and restrictions for uses such as trail marking, camping, campfires, toilets, and other activities will be defined. Methods of controlling off-road use will be prescribed. Planning will include consultation with American Indians.

**Grazing Management.** Livestock grazing has occurred in the monument for approximately 150 years. Sheep were originally the major domestic grazer; now it is cattle. There are several existing grazing allotments in the monument, but as specified in the El Malpais legislation they will expire at the end of 1997. Until this time, provisions must be made for operators to maintain herds and associated ranching developments such as stock tanks, pipelines, fences, and corrals. Ranching developments on federal land will be removed (after assessments of sites and structures to determine if they have historic values). El Malpais staff is preparing a grazing management plan with assistance from the NPS Southwest Regional Office to address the many issues related to grazing. Grazing often results in adverse impacts on resources, including wildlife, vegetation, soils, cultural sites, and recreation. The full effect of past and present livestock grazing on monument resources is unknown, and as a result a program to document the impacts from grazing will be recommended.

**Lava Tube and Ice Cave Management.** The monument contains extensive lava tube systems. A lava tube inventory (NPS, Carlton 1988b) was conducted shortly after the monument was established, but because of limited time and funds this survey was not comprehensive. The contractor explored and documented the 16-mile central tube system within the **Bandera** lava flow and several miles of tributary tubes. Other lava tubes in the monument have yet to be studied.

Accessible caves are very popular with visitors. Caving is also a hazardous recreational activity. The number of cave visits is unknown, as is the extent of impacts. Human use is likely disturbing fragile cave features including biota and mineral and lava formations. Research and more complete lava tube inventories are needed.

Caves as well as lava surface resources hold special significance to local American Indians. This concern is recognized by the Park Service, and measures are needed to ensure that American Indian interests are protected.

Several tubes containing ice formations are referred to as "ice caves." These caves may contain water and/or temperature-sensitive resources. The ice may preserve important prehistoric atmospheric, climatic, and vegetative (pollen) data. Very little is known of the dynamics of ice formation or the impacts of visitors. Research and monitoring are needed to determine the distribution and dynamics of ice formation, annual/seasonal cycles that influence ice formation, conditions needed to ensure permanence of ice, ecologic conditions and species associated with the ice caves, and effects of visitation on the ecology of ice caves.

To obtain the needed data, additional lava tube and ice cave inventories and research will be done. A comprehensive cave management plan will be prepared. The plan will determine specific management policies and appropriate use levels, identify long-term monitoring needs, and develop measures to protect cave resources including ice.

**Wildlife Management.** The status of monument wildlife is only partially known. Wildlife inventories are incomplete, and the extent that wildlife species use the different habitats in the monument is unknown. More information is needed, including species density, population numbers, range conditions, historical use, and identification of critical habitat. It is assumed that the lack of water and rugged terrain will continue to be limiting factors for monument wildlife.

Management objectives will be to perpetuate native wildlife species and natural population numbers, to be accomplished through protection and enhancement of critical habitat and prevention of illegal hunting and trapping. Supplementation and reintroduction of certain species may be feasible and, if so, will be coordinated with appropriate state and federal agencies. Wildlife protection will be encouraged on public and private lands within and adjacent to the monument through the establishment of cooperative agreements. Extirpated wildlife species such as bighorn sheep will continue to be studied for possible reintroduction (see later section on reintroduction of bighorn sheep).

**Bats** – El Malpais provides both summer and winter habitat for a variety of bats including the Mexican free-tailed; Townsend's big-eared; hoary; pallid; and several species of myotis, including long-eared, fringed, long-legged, and small-footed. There is far less chance that the monument provides habitat for others, including silver-haired, big brown, and spotted bats. Several of these species are listed as federal notice of review species (category II), which means there is concern the species is in jeopardy but information is insufficient to decide on official listing as a threatened or endangered species (see later discussion on threatened and endangered species).

Several bat caves/colonies exist in the monument, but by far the most popular for visitors is Bat Cave near El Calderon. The cave provides summer habitat for a large colony of Mexican free-tailed bats and winter habitat for a much smaller population of various species including the Townsend's big-eared bat (a federal notice of review species). Evening bat flights are a popular visitor attraction in summer and, although not promoted, popularity is increasing. During the 1950s, ecologist Alton Lindsey estimated the summer Mexican free-tailed population at Bat Cave at approximately 40,000 bats. Today, the population may be as low as 6,000. The reasons for decline are unknown, but from studies done on the Mexican free-tailed bat colony at Carlsbad Caverns National Park and other management experience it has been found that bat colonies in general were affected by ingesting pesticides on the insects they eat. Also, the impact of past visitors entering Bat Cave at El Malpais is unknown and is possibly a contributing factor. Smoke or shining lights on sleeping bats will adversely impact the colony. An ecological study is needed to determine bat habitat and population, migration patterns, local impacts on this colony, the effects of increased visitation on the colony, and what other potential problems may exist. Although there is particular interest in obtaining information about the Mexican free-tailed bat colony and the population of Townsend's big-eared bats at El Calderon, this information is also needed for other bat species and colonies in the monument.

Disturbances to the bat population near El Calderon will be mitigated by ranger patrols, closing the cave by signing, and educating visitors to observe the bat flights from restricted areas. If these measures are not effective, additional protective measures will be prescribed.

Other problems related to bats are that they carry and can transmit disease to humans, including rabies and histoplasmosis. Visitors will be warned about these dangers, which will help reduce the potential for disease transmission.

**Mule Deer** -The monument mule deer population is probably small. The major limiting factors are lack of water and the rugged lava. The northern part of the monument near El Calderon appears to have the greatest deer concentration, its shrub-conifer and deciduous vegetation providing excellent summer and winter habitat.

The NMDG&F performs a local hunter license census on game populations including mule deer. However, this census does not provide accurate estimates on monument wildlife populations because hunting is prohibited in the monument and state hunting units do not coincide with the monument boundaries.

Information needed on mule deer includes their population, identification of migration patterns and routes, location of summer and winter range, and buck:doe:fawn ratios.

**Elk** – Elk are neither numerous nor permanent monument residents. They occasionally use areas near **Bandera Crater**, however this use is inconsistent and probably only transient. Lack of water is likely the limiting factor.

**Turkey** – The turkey population in the monument is unknown. Sightings are frequent near East Rendija. A preliminary estimate by NMDG&F personnel indicates that the monument once provided suitable habitat for a much larger number. As with mule deer, major limiting factors are most likely lack of water and the rugged terrain.

Information needed on turkeys includes their population, existing and potential habitat locations, and tom:hen ratios.

**Pronghorn** – Pronghorn occupy the monument in the area south of the Laguna flow. Areas along the southern monument appear to provide adequate forage, however water is very limited. Areas just south of the monument support pronghorn, but there is a high fawn mortality. The reasons for the high mortality are unknown, but may be predation, lack of food and water, and competition with cattle.

Information needed includes a population estimate.

**Raptors** – The monument supports several raptor species, including kestrel, prairie, goshawk, red-tailed, Cooper's, and rough-legged hawks; great horned, pygmy, long-eared, and burrowing owls; and turkey vultures. Golden and bald eagles are occasionally seen foraging in the monument. The sandstone cliffs east of the monument provide raptor nesting habitat, and cave entrances and collapse structures provide owl nesting habitat. However, nesting has been declining in recent years for unknown reasons. Raptor poaching occurs elsewhere in the United States, but it is not known if it is a problem in the El Malpais area. Carcass poisoning to control coyotes likely results in some raptor mortality.

Important raptor nesting/foraging areas need to be identified, and actions need to be developed to protect these species.

**Black Bear** – Black bear are occasionally seen in the Bandera Crater area. Bears are not now a serious problem, but with development of monument facilities, human/bear encounters could become a problem in the monument.

Black bear habitat and numbers need to be determined. A bear management plan may be needed if human/bear encounters begin. Because bears are so wide ranging and peripheral areas may be involved, bear management strategies should be developed in cooperation with state and federal

agencies. Monument facilities such as the campground and residences may need to be designed with consideration of potential bear problems, and animal-proof trash containers will be used at developed areas.

To systematically increase information about wildlife and improve management decisions, population inventories and habitat studies will be conducted. As needs for specific programs are identified, cooperative wildlife management agreements with state and federal agencies and appropriate consultation with local American Indian groups will be established. Species management plans will be developed as needed.

### **Threatened and Endangered Species**

**Management.** Management of threatened and endangered plant and animal species will be as follows.

**Plant Species** – The potential exists for the presence of certain proposed or nominated threatened, endangered, or federal "notice of review" plant species within the monument. However none were identified during a survey of representative area habitats completed in 1979. The survey recommended a late-season inventory to better identify late-flowering threatened and endangered species; this additional survey was never performed. Federal notice of review species do not yet have legal protected status, however NPS mandates require protective measures for all species including notice of review candidates.

**Animal Species** – There are numerous threatened (t), endangered (e), and federal notice of review (r) animal species known (k) or having potential (p) to occur in the monument. These include the peregrine falcon (e, p), bald eagle (e, k), black-footed ferret (e, p), Townsend's big-eared bat (r, k), white-faced ibis (r, p), Swainson's hawk (r, p), ferruginous hawk (r, p), spotted bat (r, p), mountain plover (r, p), long-billed curlew (r, p), "western" yellow-billed cuckoo (r, p), and "southern" spotted owl (r, p).

Further information is needed about monument use or critical habitat of the above-listed animals or any other threatened or endangered species that are discovered.

To identify and protect potential threatened and endangered and federal review species, a two-phase approach will be taken. The first involves survey and assessment of all proposed development sites for these species. The second involves completion of a monument-wide survey. If threatened, endangered, or federal notice of review species are identified, protective measures will be developed in consultation with the USFWS. These protective measures will include thorough determination of distribution, monitoring, and protection of habitat.

**Vegetation Management.** There is no detailed, comprehensive inventory of monument vegetation. The Bureau of Land Management has used remote sensing to develop a small-scale (1 :100,000) vegetation map that includes the monument. The map identifies eight vegetative communities in the monument. However, on a larger scale, little information on plant communities is available, and BLM's data is not adequate for site-specific planning and specific resource management actions and decisions. The rugged lava has prevented identification and exploitation of monument vegetation, including vegetation in many backcountry areas and kipukas (which are isolated islands of older rock and vegetation surrounded by lava flows). Initial evaluation shows fragile species and unusual plant associations, including uncommon lichen species and grasses, in certain kipukas and other restricted habitats such as caves and crevices indicates. Two New Mexico sensitive species, grass fern (*Asplenium septentrionale*) and maidenhair spleenwort (*Asplenium trichomanes*) were identified in a 1979 survey. Some kipukas have such undisturbed and vigorous associations of native species as to suggest the possibility of establishing one or more research natural areas.

As described earlier, livestock have grazed in the monument for at least a century. Grazing has likely altered the native vegetation and introduced exotic plant species, but the extent is unknown.

As backcountry/wilderness use increases, the potential for impacts on vegetation will also increase. Sensitive plants could be damaged or destroyed, possibly resulting in the loss of some plants. Plants and vegetative associations need more thorough study of significance, and if appropriate, one or more research natural areas will be established to ensure preservation and to assist in long-term research needs.

To improve management of the monument's vegetation, detailed inventories and studies will be conducted and a vegetation management plan will be prepared. Plan components will include reestablishment and maintenance of native plant communities and identification and elimination of exotic species. If necessary, an exotic species management plan will be prepared. If sensitive species are present in areas proposed for development, protective measures will be taken. The vegetation management plan will be developed in conjunction with the fire management plan, the grazing management plan, the threatened and endangered species surveys, the cultural resources management plan, and other appropriate plans and studies. Also, although the Park Service has no legal requirement to do so, measures will be taken to protect the two sensitive state species (mentioned above) where they occur.

**Reintroduction of Bighorn Sheep.** It is not known how or when the bighorn sheep population – once native to the monument – was extirpated; however, this species still inhabits areas of the Zuni Mountains just west of the monument. Bighorn sheep skeletal remains have been recovered from the monument and are being evaluated by the Museum of Southwestern Biology to determine which subspecies of bighorn was endemic to the El Malpais. (Preliminary analysis indicates that they are remains of Rocky Mountain bighorn.) The bighorn is an important species that is now missing in the monument. The NMDG&F has identified El Malpais National Monument and National Conservation Area as one of 10 areas in the state for possible reintroduction of bighorn sheep. Further studies are needed to determine if this is suitable habitat. If determined practicable, a bighorn sheep reintroduction program and associated management plan will be developed in consultation with NMDG&F, BLM, USFWS, and possibly local American Indian groups.

## PROPOSED MONUMENT BOUNDARY ADJUSTMENT

Boundary issues were examined as part of the planning process, as specified in section 604 of the National Parks and Recreation Act of 1978 (16 U.S.C. 1a-5 et seq.). Authority for modifying boundaries is contained in the Land Water Conservation Fund Act amendments of June 10, 1977 (Public Law 95-42). The following boundary



modification is proposed. It should be noted that this boundary adjustment is solely an administrative change between the national monument (the Park Service) and the national conservation area (the Bureau of Land Management).

The multiagency center site presently encompasses 1,089.70 acres (T 10 N, R 9 W, sections 6, 7, and 18). The Park Service has determined that the full 1,089.70 acres is unnecessary for development of the center. No advantages would be gained by placing the center farther south to justify the extra land and development costs. Also, the additional acreage is not needed to protect or enhance the viewshed from the center. A boundary adjustment is proposed whereby the multiagency center site would be reduced to about 481 acres (see Boundary Proposal map). The preferred alternative includes deleting the southern half of section 7 and the northern half of section 18 (now within the monument) and placing these 640 acres into the national conservation area. A 54-acre parcel of land just north of the monument and southeast of the site access road (currently within the national conservation area) will become part of the national monument.<sup>28</sup> This land is currently in single private ownership and is undeveloped except for fences and some vehicular ways. A 19-acre parcel of land in the northwestern part of section 7 and the southwestern part of section 6 (a National Guard Armory is proposed for that area) will become part of the national conservation area.

## STAFFING

Over the next 10 years visitation to El Malpais National Monument is expected to increase greatly. During this time the Park Service will acquire private lands and develop numerous new facilities. Public use of the monument's facilities, roads, and trails will require additional staff to ensure proper resource protection and visitor services.

At full implementation of the preferred alternative, total staffing would be 31.7 full-time equivalents (FTEs). Above the existing level of staffing, this will require an increase of 1.0 FTE in the Division of

Management and Administration, 7.3 FTEs in the Division of Visitor Services and Resource Management, and 2.0 FTEs in the Division of Maintenance. Table 2 summarizes the monument staff as proposed under the preferred alternative. Both existing (authorized) staff and the proposed additions are indicated in the table. A description of the work to be performed by the proposed staff is in appendix K.

Following acquisition of the **Bandera** Crater property, the private lands along NM 117, and the multiagency center site, reorganization of the monument will occur. It is proposed that two districts will be established to provide protection and visitor service on both sides of the monument. The east district staff, responsible for the multiagency center and the eastern part of the monument, will live in Grants and have office space in the leased headquarters building along with other personnel serving the whole monument. Most west district personnel, responsible for the **Bandera** visitor center and the western portion of the monument, will be required to occupy the residences near **Bandera** Crater.

## CARRYING CAPACITY

Carrying capacity is a concept for estimating the level of a particular use that a unit of land can support without resource degradation. As applied to outdoor recreation areas, carrying capacity is the maximum theoretical level of visitation that a parkland could support before natural, cultural, and experiential resources would begin to be damaged.

The general lack of baseline resource data about El Malpais National Monument makes it difficult to accurately determine the monument's carrying capacity. There is, however, enough data to conclude that adverse resource impacts will probably not occur. This conclusion is based on the low level of visitor use, actual and projected, and the intention behind the proposed development to contain visitors within nonsensitive areas. Because baseline data is lacking, a study will be conducted to determine the potential impacts of visitor use and the ability of the resources to withstand those

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28. See the El Malpais National Monument **Land Protection Plan** for more specific information on these boundary adjustments.

**TABLE 2: STAFFING REQUIREMENTS UNDER THE PREFERRED ALTERNATIVE (INCLUDING EXISTING STAFF)**

<b>POSITION</b>	<b>GRADE</b>	<b>SALARY (1989 \$)</b>	<b>FTE</b>
<b>DIVISION OF MANAGEMENT AND ADMINISTRATION</b>			
<u>Existing Authorized Staff</u>			
Superintendent*	GS-13	\$ 47,906	1.0
Administrative Officer	GS-09	29,456	1.0
Clerk Typist	GS-04	15,868	1.0
Clerk Typist (Seasonal)	GS-03	4 . 1 8 6	<u>.3</u>
Authorized Annual Total		\$97,416	3.3
<u>Proposed Additions to Staff</u>			
Purchasing Agent	GS-07	<b>\$25,654</b>	<u>1.0</u>
Total Increase		<b>\$25,654</b>	1.0
<b>Proposed Division Total</b>		<b>\$ 123,070</b>	4.3
<b>DIVISION OF VISITOR SERVICES AND RESOURCE MANAGEMENT</b>			
<u>Existing Authorized Staff</u>			
Chief Ranger*	GS-12	\$41,607	1.0
Supervisory Park Ranger	GS-11	33,630	1.0
Resource Management Specialist	GS-09	29,456	1.0
Park Ranger (Interpretive Specialist)*	GS-09	29,456	1.0
Supervisory Park Ranger	GS-09	29,456	1.0
Park Ranger (Area Ranger)	GS-07	25,654	1.0
Park Ranger (Protection and Backcountry)	GS-05	17,752	1.0
Park Ranger (Protection)	GS-05	17,752	1.0
Park Ranger (Interpretation)	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-05	10,651	0.6
Park Ranger (Seasonal)	GS-05	8,876	0.5
Park Ranger (Seasonal)	GS-04	7,505	0.5
Park Ranger (Seasonal)	GS-04	7,505	0.5
Park Ranger (Seasonal)	GS-04	7 . 5 0 5	<u>0.5</u>
Authorized Annual Total		\$284,557	11.6
<u>Proposed Additions to Staff</u>			
Resource Management Specialist (Fire/Veg.)	GS-07	23,455	<b>1.0</b>
Park Ranger (Interpretation)	GS-07	25,564	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (General)	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-04	7,505	0.5
Dispatcher/Clerk	GS-04	15,868	1.0
Park Ranger (Seasonal)	GS-03	5,840	0.4
Park Ranger (Seasonal)	GS-03	5 . 8 4 0	<u>0.4</u>
Total Increase		\$137,328	7.3
<b>Proposed Division Total</b>		<b>\$421,885</b>	18.9

## DIVISION OF MAINTENANCE

### Existing Authorized Staff

Facility Manager*	<b>GS-09</b>	<b>\$29,456</b>	1.0
Maintenance Worker	WG-07	22,129	1.0
Work Leader	WL-07	<b>22,456</b>	1.0
Maintenance Worker	WG-05	19,422	1.0
Maintenance Worker	WG-05	19,422	1.0
Seasonal Laborer	WG-03	<b>7,760</b>	<b>0.5</b>
Seasonal Laborer	WG-03	<b>7,760</b>	<b>0.5</b>
Seasonal Laborer	WG-03	<u>7,760</u>	<u>0.5</u>

Authorized Annual Total		\$ 136,165	<b>6.5</b>
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### Proposed Additions to Staff

Maintenance Mechanic	WG-09	<b>22,874</b>	1.0
Maintenance Worker	WG-05	<u>19,422</u>	<u>1.0</u>

Total Increase		<b>\$42,296</b>	<b>2.0</b>
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<b>Proposed Division Total</b>		<b>\$178,461</b>	<b>8.5</b>
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<b>PROPOSED MONUMENTWIDE TOTAL</b>		<b>\$723,416</b>	<b>31.7</b>
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Total Increase Over Authorized Staff		<b>\$205,278</b>	10.3
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\* Indicates staff who will have support duties for the Masau Trail.

impacts. The study will include a component to examine how the level of recreation use affects the overall visitor experience. Monument staff can begin studying the effects of visitor use on resources by documenting, mapping, and photographing fragile resources and terrain conditions. This will assist in determining resource carrying capacity.

## **FUTURE PLANS AND STUDIES**

In addition to the plans and studies that have already been described, the following are needed and will be initiated under the preferred alternative.

### **Visitor Center Facility Plan**

The NPS Harpers Ferry Center will prepare facility plans concurrently with the preparation of the comprehensive design for the multiagency center and the **Bandera** visitor center. This will ensure that the buildings and their interpretive contents, such as exhibits and audiovisual media, are compatible, nonrepetitive, and functional and that they address the needs of mobility, sensory, and mentally impaired persons.

### **Monumentwide Sign Plan**

A sign plan will be prepared by the monument staff in consultation with the Bureau of Land Management to ensure a common appearance and format for signs used in both the monument and conservation area. Monument signs will be in conformance with NPS sign standards and will be compatible with the natural features of the area, yet easily visible from roads and trailheads. Sign messages will be clear, concise, and quickly understood. Regardless of the message conveyed, each sign will be recognized as an El Malpais National Monument/National Conservation Area sign. The sign plan will be prepared before the wayside exhibit plan described below so that exhibit planners can follow monument sign standards.

### **Wayside Exhibit Plan**

A wayside exhibit plan for both the monument and the conservation area will be prepared by the NPS Harpers Ferry Center in consultation with NPS and

BLM staff and regional and state offices. These entities will coordinate efforts to avoid a piecemeal approach to interpretation. Wayside exhibits and signs will be designed to create a visual similarity (continuity of design that can be easily identified by visitors) that will reinforce the fact that the national monument and national conservation area are both part of El Malpais.

## **Media Plans/Special Considerations**

A recurrent theme presentation at El Malpais centers on the world views of other cultures. All stages of media production for audiovisual products, indoor exhibits, wayside exhibits, and publications associated with this theme will be developed in consultation with tribal representatives. American Indian consultation on content will begin during the initial research.

## **Visitor Expenditure Patterns**

There is a need to understand the expenditure patterns of visitors to El Malpais National Monument. It is especially important to determine the impacts of these expenditures on surrounding communities. A generalized economic impact assessment methodology is currently under development for the National Park Service. The methodology is being tested at Great Basin National Park (Nevada), another recent addition to the national park system. The methodology includes generation of baseline data, prediction of impacts, and measurement of actual economic impacts over time and is intended to be applicable in other parks. Management should consider implementing an economic impact study using this methodology at El Malpais as soon as the monument becomes fully operational.

## **Carrying Capacity Study**

As noted in the section on carrying capacity, there is a need to initiate the collection of additional baseline resource and visitor use data as soon as possible. This data will allow management to more accurately assess the ability of resources to withstand impacts associated with visitor use.

## DEVELOPMENT PRIORITIES AND COSTS

The phasing and estimated costs of development are summarized below. These estimates are gross costs (construction cost plus project planning, construction supervision, and contingencies) and are in 1989 dollars. More detailed cost estimates are provided in appendix L. The general order of rationale for prioritizing developments as well as meeting other objectives for the monument is to

- meet legislative requirements for developing visitor services
- meet needs for public life, health, and safety
- consult with American Indians on matters of access, development, interpretation, and protection of resources
- promote the orderly phaseout of grazing by the end of 1997
- identify fragile and significant resources requiring special management
- create the necessary infrastructure for providing a full spectrum of visitor opportunity
- provide staff-related facilities to support resource and visitor protection
- cooperate with the Bureau of Land Management in taking the actions needed to manage both the national monument and conservation area

Development priorities for the 13 areas were developed by the planning team, with input by monument managers. The specific development actions at each area are shown in order of priority. However, some items may not be developed in the literal order shown in the entire list. Many factors, including land acquisition and availability of road and other construction funding, also affect the eventual order of development.

**TABLE 3: DEVELOPMENT PRIORITIES AND COSTS – PREFERRED ALTERNATIVE**

	<b><u>\$ fin thousands)</u></b>
<b>1. Bandera Crater Area</b>	
. adapt trading post complex for NPS visitor purposes	\$174
. upgrade trails to <b>Bandera</b> Crater, Ice Cave, and lava surface features, including wheelchair-accessibility features	232
. construct entrance and one-way tour road, visitor center, parking for visitor center and trading post, utility systems, and visitor center nature trail and parking	7,565
. construct maintenance and residential area roads, buildings, and utilities	<b>2,294</b>
. develop remaining trails (Spattercone Valley, Cerro <b>Bandera</b> , connectors, etc.)	334
. recontour and restore cinder and borrow pits to natural appearance	312
<b>2. Multiagency Center</b>	
. construct utilities, entry road, parking, and visitor center	3,347
. develop trail	32
<b>3. Dripping Lava Cave</b>	
. construct spur road/parking	381
. develop trail to cave, stairs, and trail inside cave	83
. develop trail to Lava Crater	17
<b>4. El Calderon</b>	
. close and revegetate south end of Bat Cave road; construct new gravel road to within 1/4 mi. of Bat Cave	321
. construct gravel parking, vault toilets, trailhead, and trails to Bat Cave, Double Sinks, and Junction Cave	118
. improve El Calderon Road for through-traffic to south	484
. close and revegetate Corral road	119
. designate viewing area for bat flights	
<b>5. Sandstone Bluffs/Las Ventanas</b>	
. pave Sandstone Bluffs road and redesign parking; construct vault toilets, provide lockable gate	2,157
. develop short wheelchair-accessible trail to overlook	14
. construct paved spur road to Las Ventanas parking/trailhead	130
. develop trail to natural arch and Las Ventanas sites	52
<b>6. East Rendija Trailhead/Cerro Bandera</b>	
. realign Route 42 (first 2.0 mi.) and upgrade route leading to East Rendija to a gravel standard; construct parking and vault toilets at East Rendija	1,958
. construct trailhead and trails to Big Skylight and Four-Window caves; mark primitive trails to Seven Bridges and Caterpillar collapses	66
. construct Cerro <b>Bandera</b> parking, trailhead, and trail to summit	71
. revegetate closed portion of previously used Route 42 (east of Cerro <b>Bandera</b> )	78
. construct gravel roadside parking, trailhead, and loop trail to lava wall	50
<b>7. The Narrows</b>	
. construct parking and short wheelchair-accessible trail	119
. mark trail onto <b>McCarty's</b> flow	22

<b>8. Zuni-Acoma Trail (west end)</b>	
• construct wheelchair-accessible parking spaces and trail to overlook	6
• rehabilitate gravel parking area and spur road	3
<b>9. Acoma-Zuni Trail (east end) (if easement acquired)</b>	
• construct paved parking area and trailhead	131
<b>10. McCartys Crater (option 1)</b>	
• construct spur road, parking, and trail to overlook	175
<b>11. East Rendija Campground</b>	
• construct spur road, campsites, vault toilets	416
<b>12. Braided Cave Trailhead</b>	
• install lockable gate	3
• formalize dirt parking area and trailhead at gate; develop trail to Braided Cave	39
<b>13. Roadside Kiosk Along NM 117</b>	
• construct structures and parking and install signs	<u>26</u>
<b>TOTAL (in thousands)</b>	<b>\$21,330</b>

## MINIMUM REQUIREMENTS ALTERNATIVE

As an alternative to the preferred alternative (the draft general management plan) this minimum requirements alternative contains the minimum feasible actions and development that would meet legislative mandates, alleviate health and safety concerns, and still provide essential protection for the cultural and natural resources of El Malpais National Monument. Fewer interesting features of the monument would be available for public use under the minimum requirements alternative, and in general, access would not be as improved as under the preferred alternative. It should be noted that this alternative, although meeting legislative requirements, is otherwise close to the existing conditions of the monument and thereby also serves as the “no-action” alternative for the environmental assessment. (A true no-action alternative -which would mean a continuation of all existing conditions and no proposals for developing the two visitor centers as required by law – is not a feasible or viable alternative for El Malpais National Monument.) The details of this alternative are shown on the following General Development – Minimum Requirements Alternative map. A table later in this section compares various aspects of the preferred and minimum requirements alternatives.

### VISITOR FACILITIES/DEVELOPMENT

#### Administrative Headquarters

Under this alternative, plans for monument administrative headquarters would be the same as for the preferred alternative.

#### Multiagency Center

Under the minimum requirements alternative, the multiagency center near Grants would be the same as under the preferred alternative.

#### Bandera Crater Area

Although the new Bandera visitor center and its paved parking area would be in a different location under this alternative – slightly east of the existing trading post<sup>28</sup> (see Bandera Crater Area DCP – Minimum Requirements Alternative) -the facility and most of its functions would be the same as under the preferred alternative. Consideration would also be given to the impacts of the Zuni Railroad if that project is initiated, as described under the preferred alternative.

The existing road leading south toward the trading post from NM 53 would be paved. However, the southern end of the improved road would be realigned toward the east to set the visitor center and its parking area apart from the trading post and reduce visual impact of modern development on this historic scene. (There would be no one-way tour road as under the preferred alternative.)

The existing trading post complex would be adaptively reused as described under the preferred alternative. At least part of the cinder parking lot would be retained; the parking area would be at least the same size as under the preferred alternative. There would be no picnic tables in the Bandera area because of space limitations.

The existing trail to the ice Cave would be improved and would be interpreted and made wheelchair-accessible; a new wheelchair-accessible trail to the nearby lava surface features would also be built, as under the preferred alternative. The existing trail to Bandera Crater would be interpreted. This trail would also be brought up to safety standards. (Most of these trails would be on an existing unused motor route.) The stairway to the Ice Cave would also be replaced, and a viewing platform for handicapped visitors would be installed as described under the preferred alternative.

Access to Dripping Lava Cave would be provided by a primitive trail from the trading post area, and stone steps would be provided into the cave. There

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28. Careful design and choice of site will ensure easy visitor access while preserving the historic character of the adjacent trading post complex.

would be no trail to Lava Crater and no interconnecting new trails to Sandstone Ridge, Spattercone Valley, or other lava surface features.

The four single-family residences, four-unit apartment building, and four-bay maintenance building would be the same as described under the preferred alternative.

### **East Rendija Area**

There would be no improvement to or realignment of the existing access from NM 53 to the East Rendija area. Better county maintenance along existing Route 42 would be encouraged. Parking at the trailhead would remain informal (along the roadside), and there would be no campground or vault toilets. The Cerro Bandera summit and lava wall trails would not be built. Vehicular access to East Rendija would remain primitive, with passage only for high-clearance vehicles during dry conditions.

### **Braided Cave**

Access to Braided Cave area would be on existing high-clearance roads. Parking would be informal, as existing, and there would be no marked route to Braided Cave.

### **El Calderon Area**

Access from NM 53 and parking for Junction and Bat caves would be on the existing high-clearance road, and there would be no improvements to the El Calderon road or changes in use of the Corral road. Parking would be informal, along the roadside.

There would be no trails to Bat Cave or Double Sinks. Junction Cave would not be marked for public use. The east tube of Bat Cave would be closed for visitor health and safety reasons and to protect the bats; however, bat viewing would be allowed from a safe distance as described under the preferred alternative. Exploration of the west tube of Bat Cave would not be encouraged.

### **Zuni-Acoma/Acoma Zuni Trail**

The west end access road, parking, and short gravel trail to the initial viewpoint would remain as existing.

The east end access road and parking would be as described under the preferred alternative.

### **Las Ventanas**

At Las Ventanas, no trails or other formal means of access would be provided. As described below, there would be a gate on the Sandstone Bluffs road at NM 117 that would be closed at night.

### **Sandstone Bluffs Overlook**

The access road to Sandstone Bluffs from NM 117 would remain gravel surfaced under this alternative, although one short segment would be realigned for safety. The parking area would be redesigned but not paved, and vault toilets would not be provided (toilet facilities would be available on the east side of NM 117 at the BLM visitor contact station). A wheelchair-accessible trail would be built to one overlook, and a lockable gate at NM 117 would be closed at night to improve resource protection of the Sandstone Bluffs and Las Ventanas areas, as described under the preferred alternative.

### **The Narrows**

There would be no development at the Narrows under the minimum requirements alternative, and therefore no opportunity for visitors to see at close range the surface features of the McCartys flow.

### **McCartys Crater Viewpoint**

There would be no development at this location.

### **Roadside Kiosk along NM 117**

The kiosk would be as described under the preferred alternative.

## BANDERA CRATER VISITOR CENTER

- BUILD NEW HANDICAP-ACCESSIBLE VISITOR CENTER EAST OF TRAIL, POST RAVE; SLIGHTLY REALIGN ACCESS FROM NM 53, RAVE PARKING
- REHABILITATE AND ADAPTIVELY USE CONTRIBUTING HISTORIC STRUCTURES, REMOVE NONCONTRIBUTING STRUCTURES
- MAINTAIN PRIMITIVE ACCESS TO TRIPPLING, LAVA CAVE
- DEVELOP UTILITY SYSTEM FOR VISITOR CENTER, MAINTENANCE/RESIDENCE AREAS; TRADING POST
- MAKE TRAILS TO ICE CAVE; LAVA SURFACE FEATURES WHEELCHAIR ACCESSIBLE, PROVIDE NEW STAIRS; CHAIRLIFT AT ICE CAVE

## NPS RESIDENCE; MAINTENANCE AREAS

- CONSTRUCT PAVED ACCESS FROM NM 53, PAVED PARKING
- BUILD 4 RESIDENCES, ONE 4-UNIT APARTMENT BUILDING
- BUILD 4-BAY MAINTENANCE BUILDING
- DEVELOP UTILITY SYSTEM

## EL CALDERON AREA

- USE EXISTING ACCESS TO BAT CAVE
- CLOSE EAST SIDE OF BAT CAVE, BUT ALLOW VIEWING OF FLIGHTS

## ZUNI-ACOMA TRAIL

- USE EXISTING ACCESS; TRAIL TO OVERLOOK

## MULTI-AGENCY VISITOR CENTER

- CONSTRUCT PAVED ACCESS FROM EAST I-40 INTERCHANGE
- CONSTRUCT HANDICAP-ACCESSIBLE ORIENTATION/INFORMATION CENTER; PAVED PARKING
- DEVELOP SHORT TRAIL

## RATLER STATION (BLM)

- BUILD STATION, PAVED ACCESS, PARKING, RESIDENCE
- DEVELOP INTERPRETIVE TRAIL

## SANDSTONE BLUFFS

- REALIGN EXISTING GRAVEL ACCESS
- REDESIGN EXISTING GRAVEL PARKING, PROVIDE WHEELCHAIR-ACCESSIBLE TRAIL TO OVERLOOK
- INSTALL LOCKABLE GATE FOR OVERNIGHT CLOSURE NEAR NM 117

## ACOMA-ZUNI TRAIL

- CONSTRUCT PAVED ROADSIDE PARKING; TRAILHEAD IF EASEMENT ACQUIRED

## LA VENTANA (BLM)

- CONSTRUCT GRAVEL PARKING AREA, DEVELOP TRAILHEAD; LOOP TRAIL TO ARCH (WHEELCHAIR-ACCESSIBLE STAIR TO VIEWPOINT)
- PROVIDE VAULT TOILETS

## SOUTH BK NARROWS (BLM)

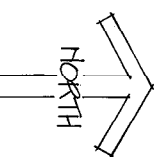
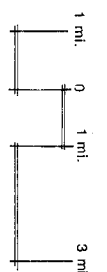
- REDESIGN GRAVEL ACCESS; PARKING
- PROVIDE PUBLIC AREA
- DEVELOP TRAILHEAD FOR CEBOLLA WILDERNESS

## NM 117 ROADSIDE KIOSK (SOUTH)

- DEVELOP PAVED ROADSIDE PARKING
- CONSTRUCT ORIENTATION/INFORMATION KIOSK

## LEGEND

- NATIONAL MONUMENT BOUNDARY (NPS)
- NATIONAL CONSERVATION AREA BOUNDARY (BLM)

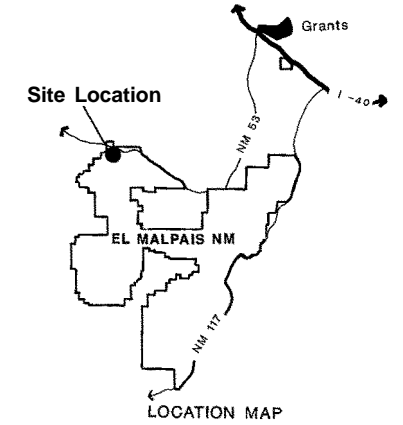
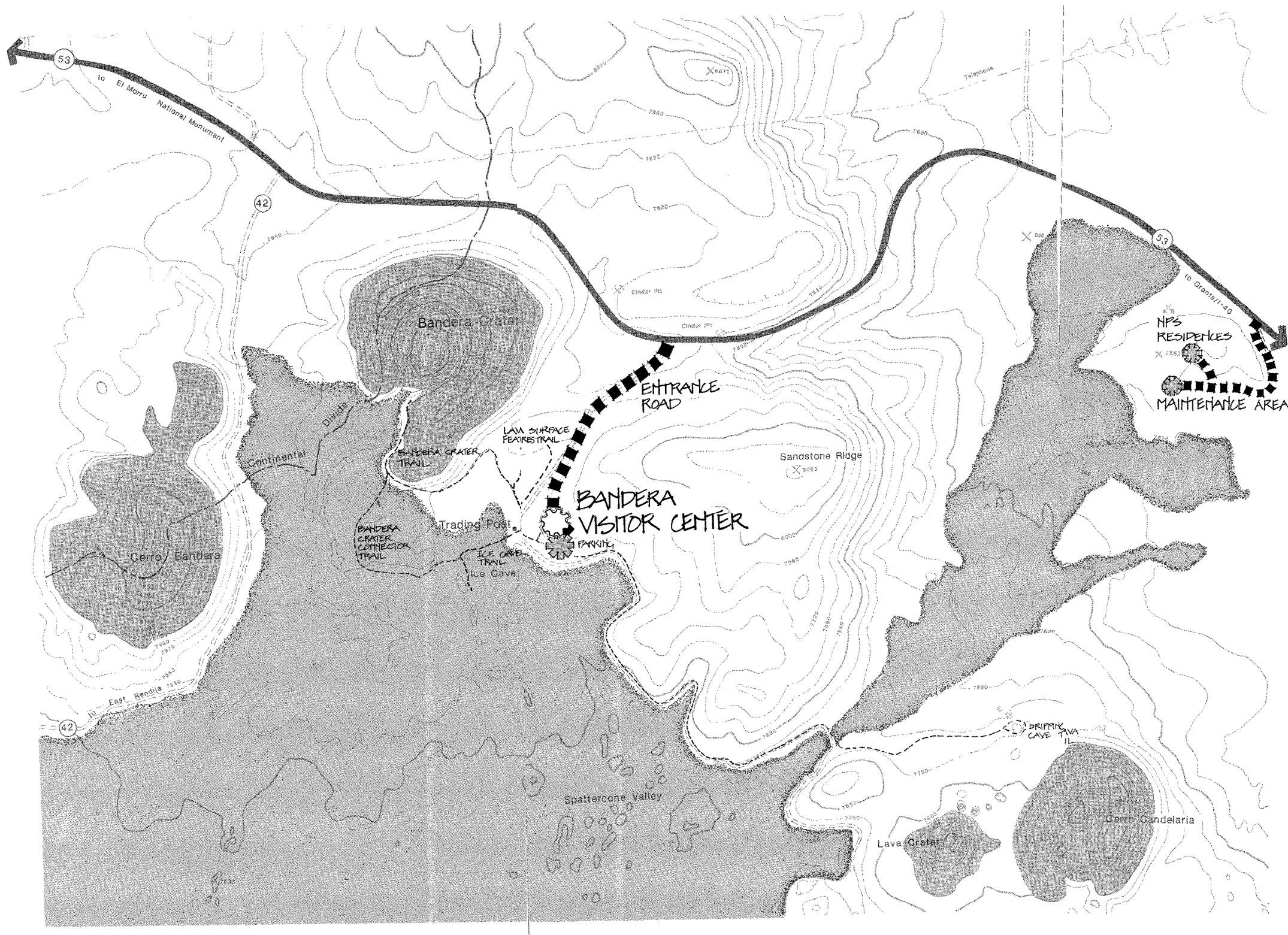


## GENERAL DEVELOPMENT

### MINIMUM REQUIREMENTS ALTERNATIVE

### EL MALPAIS NATIONAL MONUMENT

### U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE



# BANDERA CRATER AREA DCP (MINIMUM REQUIREMENTS ALTERNATIVE)

EL MALPAIS NATIONAL MONUMENT  
U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/JULY 1989/103/20,011

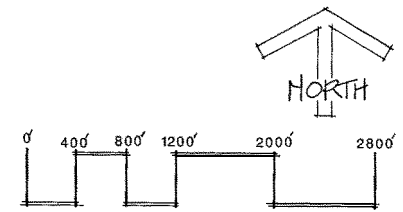
**LEGEND**

■■■■■■■■ PROPOSED PAVED ROAD \*

----- PROPOSED NEW TRAIL OR UPGRADE \*

----- EXISTING DIRT ROAD

\* ROAD, PARKING, TRAIL ALIGNMENTS ARE APPROXIMATE. ACTUAL ALIGNMENTS TO BE DETERMINED.



## **VISITOR SERVICES/INTERPRETATION**

The areas with the same development as proposed under the preferred alternative and the Sandstone Bluffs overlook would have the same plan for visitor services and interpretation. The visitor services and interpretation specifically related to viewing the bats at Bat Cave would also be provided under the minimum requirements alternative.<sup>29</sup> For areas where development is not proposed under the minimum requirements alternative, the visitor services/interpretation plan described under the preferred alternative would not apply. Although the Bandera visitor center would be in a different location and there would be fewer trails in the Bandera area under the minimum requirements alternative, the visitor services and interpretation plan for those facilities and trails would be basically as described under the preferred alternative.

Facilities for special populations would be the same as under the preferred alternative with the exception of the Narrows, which would have no development, and visitors in wheelchairs would not have the opportunity to see lava features in this area.

Recreational activities in the areas proposed for development under the minimum requirements alternative would be basically the same as under the preferred alternative. However, because there is less overall development proposed, fewer recreational activities would be available under the minimum requirements alternative. Frontcountry sight-seeing would be focused at the Bandera Crater and Sandstone Bluffs areas. There would be fewer trails in the Bandera area, and therefore fewer recreational activities.

## **CULTURAL RESOURCES MANAGEMENT**

There are no significant differences between the preferred and minimum requirements alternative regarding the treatment of cultural resources. Cultural resource identification, documentation, evaluation, protection, interpretation, management,

and collections management/curation are keyed to a basic level and type of cultural resource management as defined by law and NPS policies.

With less development under the minimum requirements alternative, fewer sites would be disturbed (i.e., less impact); however, the intensity of survey and protection would be the same as under the preferred alternative – except there would be no mitigation necessary for removing backfill and stabilizing the tower kiva at Las Ventanas as proposed under option 2 of the preferred alternative, and there would be no historic structures report for Las Ventanas under the minimum requirements alternative.

The minor differences between the two alternatives derive primarily from the location, scope, and timing of development. As under the preferred alternative, areas to be developed or that have serious threats to cultural resources would require documentation and evaluation sooner than the rest of the monument.

Also, under the minimum requirements alternative, there would be less staff available for resource protection.

## **NATURAL RESOURCES MANAGEMENT**

There would be no significant difference in the plan for natural resources management under the minimum requirements alternative, although with less development fewer sites and resources would be disturbed -which means fewer impacts. The proposed management is a basic level that is required by legislative mandates and NPS policy. However, less staff would be available for resource protection under the minimum requirements alternative.

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29. These areas include Dripping Lava Cave, Lava Crater, Cerro Bandera, Spattercone Valley, Sandstone Ridge, East Rendija (including Big Skylight and Four-Windows caves and Caterpillar and Seven Bridges collapses), Braided Cave, El Calderon (including Double Sinks and Junction Cave), the Zuni-Acoma Trail (west end), Las Ventanas, the Narrows, and McCartys Crater viewpoint.

## PROPOSED MONUMENT BOUNDARY ADJUSTMENT

The boundary adjustment proposed for the multiagency center would be the same as under the preferred alternative.

## STAFFING

The additional staff proposed under this alternative would be the minimum level necessary for visitor services and resource protection. This alternative would require that 3.7 full-time equivalent (FTE) positions be added to the monument's authorized staff. Total staffing would then be 16 FTEs. Table 4 summarizes the staffing in the minimum requirements alternative. Both existing (authorized) staff and the proposed additions are shown in the table.

## CARRYING CAPACITY

The carrying capacity under the minimum requirements alternative would be the same as described under the preferred alternative.

## FUTURE PLANS AND STUDIES

The plans and studies proposed under the preferred alternative would also be initiated under the minimum requirements alternative.

## DEVELOPMENT PRIORITIES AND COSTS

The phasing and estimated costs of development under the minimum requirements alternative are summarized in table 5. These estimates are gross costs (construction cost plus project planning, construction supervision, and contingencies) and are in 1989 dollars. The general rationale for prioritizing developments as well as meeting other objectives for the monument is the same as under the preferred alternative. The specific development actions under each area are not necessarily shown in order of priority.

TABLE 4: STAFFING REQUIREMENTS: MINIMUM REQUIREMENTS ALTERNATIVE

POSITION	GRADE	SALARY (1989 \$)	FTE
<b>DIVISION OF MANAGEMENT AND ADMINISTRATION</b>			
<u>Existing Authorized Staff</u>			
Superintendent	GS-12	\$41,607	1.0
Administrative Technician	<b>GS-07</b>	<b>21,669</b>	1.0
Clerk Typist	<b>GS-03</b>	<b>15,868</b>	<b>1.0</b>
Authorized Annual Total		\$79,144	<b>3.0</b>
<u>Proposed Additions to Staff</u>			
None			
<b>Proposed Division Total</b>		<b>\$79,144</b>	<b>3.0</b>

## DIVISION OF VISITOR SERVICES AND RESOURCE MANAGEMENT

### Existina Authorized Staff

Chief Ranger	GS-11	\$33,630	<b>1.0</b>
Resource Management Specialist	GS-09	29,456	<b>1.0</b>
Park Ranger (Interpretation)	GS-07	23,455	<b>1.0</b>
Park Ranger (Protection)	GS-07	25,654	<b>1.0</b>
Park Ranger (General)	GS-05	17,752	<b>1.0</b>
Park Ranger (Seasonal)	GS-04	4,503	0.3
Park Ranger (Seasonal)	GS-04	4,503	0.3
Park Ranger (Seasonal)	GS-04	<u>3,001</u>	0.2
Authorized Annual Total		\$141,954	5.8

### Proposed Additions to Staff

Park Ranger (Interpretation)	GS-05	\$ 17,752	1.0
Park Ranger (interpretation)*	GS-05	17,752	1.0
Park Ranger (Seasonal)	GS-04	6,002	0.4
Park Ranger (Seasonal)	GS-04	<u>4,503</u>	<b>0.3</b>
Total Increase		<b>\$46,009</b>	2.7
Proposed Division Total		<b>5187.963</b>	8.5

## DIVISION OF MAINTENANCE

### Existina Authorized Staff

Maintenance Foreman	WS-08	\$ 27,286	1.0
Maintenance Worker	WG-07	22,129	1.0
Maintenance Worker	WG-05	19,422	1.0
Maintenance Worker (Seasonal)	WG-03	<u>7,760</u>	<b>0.5</b>
Authorized Annual Total		\$76,597	3.5

### Proposed Additions to Staff

Maintenance Worker (Seasonal)	WG-05	\$ 9,186	0.5
Maintenance Worker (Seasonal)	WG-03	<u>7,760</u>	<b>0.5</b>
Total Increase		\$ 16,946	1.0
<b>Proposed Division Total</b>		<b>\$93.543</b>	4.5

### **PROPOSED MONUMENTWIDE TOTAL**

**\$360,650 16.0**

### Total Increase Over Authorized Staff

**\$62,955 3.7**

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\* Indicates staff who will have support duties for the Masau Trail

**TABLE 5: DEVELOPMENT COSTS – MINIMUM REQUIREMENTS ALTERNATIVE**

	<b><u>\$(in thousands)</u></b>
<b>1. Bandera Crater Area</b>	
• adapt trading post complex for NPS visitor purposes	117
• upgrade trails to Bandera Crater, Ice Cave, and lava surface features, including handicap-accessible features	249
• realign and pave existing access road, build visitor center and parking, provide parking for trading post, develop utility system, remove noncontributing structures, improve intersections, obliterate and revegetate road, landscaping	4,736
• construct maintenance and residential area roads, buildings, and utilities	2,266
• recontour and restore cinder and borrow pits to natural appearance	312
• develop primitive trail to Dripping Lava Cave	6
<b>2. Muiltiagency Center</b>	
• construct utilities, entry road, parking, and visitor center	3,347
• construct trail	32
<b>3. El Calderon</b>	
• designate viewing area for bat flights	1
<b>4. Sandstone Bluffs/Las Ventanas</b>	
• realign gravel road and redesign parking; provide lockable gate	62
• construct short wheelchair-accessible ramp and trail to overlook	27
<b>5. Acoma-Zuni Trail (east end) (if easement acquired)</b>	
• paved spur road, parking, connecting trail, signs, intersection improvement, and landscaping	131
<b>6. Roadside Kiosk Along NM 117</b>	
• structure, parking, and signs	<u>26</u>
<b>TOTAL (in thousands)</b>	<b>\$11,314</b>

## COMPARISON OF ALTERNATIVES

The following table compares the preferred alternative and the minimum requirements alternative regarding development.

**TABLE 6: SUMMARY COMPARISON OF DEVELOPMENT**

<u>PREFERRED ALTERNATIVE</u>	<u>MINIMUM REQUIREMENTS ALTERNATIVE</u>
<b>Multiagency Center, Grants</b>	<b>Multiagency Center, Grants</b>
Construct handicap-accessible orientation/information center for travelers; develop short trail	Same as preferred
Construct paved access road from I-40	Same as preferred
Construct paved parking area	Same as preferred
<b>Bandera Crater/Lava Crater Area</b>	<b>Bandera Crater/Lava Crater Area</b>
Construct new handicap-accessible visitor center east of Sandstone Ridge with paved parking area	Construct new handicap-accessible visitor center east of existing trading post with paved parking area; size of facility and functions would be same as under preferred alternative
Construct new paved two-way access from NM 53 to new visitor center; continue road as one-way paved tour road to new parking area near trading post and an exit onto NM 53, which will be partially realigned	Pave existing two-way road from NM 53; slight realignment eastward at southern end
Adaptively reuse trading post; two of the cabins reused as restrooms and one will be restored as early tourist cabin; remove noncontributing structures; maintain rails and part of existing cinder parking lot	Same as preferred except no cabins would be used as restrooms
Construct new paved two-way spur road to Dripping Lava Cave/Lava Crater trailhead; develop trails to Dripping Lava Cave and Lava Crater	Provide trail to Dripping Lava Cave from trading post area
Develop interconnecting trails to Sandstone Ridge, Spattercone Valley, Cerro Bandera, and other lava features	No new trails
Interpret and make trail to Ice Cave wheelchair-accessible; develop wheelchair-accessible trail to nearby lava surface features interpret Bandera Crater trail	Same as preferred
Provide picnic tables near trading post, at least one wheelchair-accessible	No picnic tables in Bandera area

**PREFERRED ALTERNATIVE**

**Bandera Area (cont.)**

Construct four single-family residences, four-unit apartment, four-bay maintenance building, access road, parking, and utilities east of new visitor center

Recontour and restore cinder and borrow pits

**East Rendija Area**

Develop new trailhead and trail to top of Cerro Bandera (from spur off East Rendija road)

Gravel 6-mile access, with realignment of first 2 miles; elevate road; close and restore first 2 miles of existing road

Construct six-site (expandable to meet demand) primitive campground; no water

Develop parking area and short interpretive trail to lava wall

Formalize and gravel parking at East Rendija; develop new trailhead

Provide vault toilets at campground and trailhead

Develop trails to Big Skylight and Four-Windows caves; mark route to Seven Bridges and Caterpillar collapses

**Braided Cave**

Gate existing access road, and provide unimproved dirt parking area nearby

Mark route to Braided Cave

**El Calderon Area**

Gravel existing road to Junction Cave; construct new gravel road to new gravel parking .3 mi from Bat Cave; provide vault toilets

Develop trails to Bat Cave and Double Sinks from parking area, short trail to Junction Cave, and trail between Junction Cave and Double Sinks

Close east tube of Bat Cave but allow viewing of flights; west tube exploration not encouraged

Close Corral Road when necessary improvements are made on El Calderon road for through traffic; restore Corral Road when closed

**MINIMUM REQUIREMENTS ALTERNATIVE**

**Bandera Area (cont.)**

Same as preferred

Same as preferred

**East Rendija Area**

No trail to Cerro Bandera

No improvements to road; encourage better maintenance by county

No campground

No parking or trail

No parking or trailhead

No toilets

No trails

**Braided Cave**

Existing access; no gate

No trail

**El Caideron Area**

Existing primitive access to Bat Cave

No constructed trails to Bat Cave or Double Sinks, no trail between Double Sinks and Junction Cave, and Junction Cave unmarked

Same as preferred

No change to existing roads

**PREFERRED ALTERNATIVE****Zuni-Acoma/Acoma-Zuni Trail**

Use existing gravel road on west end; redesign existing parking; make trail to viewpoint wheelchair-accessible

If possible, acquire easement on east end and provide paved roadside parking and trailhead

**Las Ventanas****Option 1**

Construct new paved spur road and paved parking area off Sandstone Bluffs road

Develop trailhead and trail south along ridge to include natural arch, viewpoints, roomblock, tower kiva and great kiva (unexcavated but interpreted with waysides), and prehistoric road

Close Las Ventanas/Sandstone Bluffs road at night

**Option 2**

Same as option 1 except remove backfill and stabilize the tower kiva

**Sandstone Bluffs Overlook**

Realign and pave existing road; redesign and pave existing parking area; provide wheelchair-accessible vault toilets near parking

Develop wheelchair-accessible trail to overlook

Install lockable gate near NM 117

**The Narrows**

Provide roadside parking area for about six vehicles

Develop short wheelchair-accessible trail onto adjacent lava; mark trail to additional features

**McCartys Crater Viewpoint****Option 1**

Construct paved spur road, paved parking and trailhead; develop trail to viewpoint

**Option 2**

No development

**Roadside Kiosk along NM 117**

If option 2 for McCartys Crater viewpoint is chosen, construct orientation/information kiosk with paved parking along NM 117 at south entrance to monument/conservation area

**MINIMUM REQUIREMENTS ALTERNATIVE****Zuni-Acoma/Acoma-Zuni Trail**

Existing access and trail

Same as preferred

**Las Ventanas**

No access road and parking

No trails

Same as preferred

**Sandstone Bluffs Overlook**

Realign existing gravel access; redesign gravel parking area; no toilets

Same as preferred

Same as preferred

**The Narrows**

No development

**McCartys Crater Viewpoint**

No development

**Roadside Kiosk along NM 117**

Same as preferred

## OPTIONS CONSIDERED BUT REJECTED

Early in the planning process, several sites were studied for development and possible visitor use but were found unsuitable and dismissed from further consideration; some of these sites were rejected because they are places that are sacred to the American Indians. These sites are not identified in the following discussion out of consideration for their continued protection.

### MULTIAGENCY CENTER

The option of building the center in town was rejected because of legislative intent for the center to be built on the monument tract south of I-40.

### BANDERACRATERAREA

Consideration was given to a trail up to and along the rim of Bandera Crater; this was rejected because some visitors would deliberately slide down the fragile cinder slopes, resulting in unsightly damage to the resource and a possible safety hazard. The trail to the summit of Cerro Bandera was proposed as a substitute for a trail to the top of Bandera Crater.

It was decided not to establish a formal picnic area in the Bandera area because picnicking was not determined a primary function in this area. Because many people picnic from their cars, tables should be close to parking areas and not necessarily in formalized areas.

### COUNTY ROUTE 42

The option of paving the road to East Rendija from NM 53 was rejected because it would be very costly and few visitors are currently attracted to this area; the visitors who are currently attracted are interested in a primitive experience. Most visitors to the monument and conservation area will probably enter and leave from I-40 on the north and use NM 53 and NM 117 for access to most of the outstanding features of El Malpais. If large numbers of visitors were attracted to this part of Route 42 and the East Rendija area, a much higher level of staffing and development would be necessary.

### EAST RENDIJA AREA

The option of closing the access road and having visitors walk to East Rendija from Route 42 was rejected because there is existing use and at least low-standard vehicular access to East Rendija is needed because of the importance of the resources there.

### EL CALDERON AREA

The option of prohibiting the viewing of the bat flights was rejected because the public has been doing this for many years and viewing in itself is probably not harmful to bat ecology (as long as it is done at a reasonable distance). Consideration was given to encouraging use in the west tube of the cave, where there are few bats living, but this was rejected because of potential disturbance to the adjacent occupied cave. If visitors are allowed to go into the west tube, it does not seem likely that all people would stay out of the east tube, which is critical for the welfare of both the bats and the public. (Many visitors do not know that histoplasmosis can be contracted from breathing the air around bat guano.) It was also felt that nearby Junction Cave was a better opportunity to see a large cave in this area. The most logical answer seemed to be closing the west tube, allowing controlled viewing of the bat flights on the east tube from a safe distance, and making sure that visitors are aware of the possible health risks associated with a bat cave; these are the elements included in the preferred alternative for Bat Cave.

A trail around the rim of El Calderon was rejected because the view (looking out over private development in the national conservation area and a cinder pit on the side of the crater) would deter from visitor enjoyment. Also, plant life on the rim is fragile.

A metal scaffold with steps into the Double Sinks was considered. This was rejected because of the unknown impact on the resource (including ferns), the high cost for a viewing opportunity for a limited number of visitors, and the impact the stairs themselves would have on the view within the sinks.

## **ZUNI-ACOMA TRAILHEAD (WEST END)**

The option of relocating the parking area to an entirely new area was rejected because it was not cost-effective, opportunities for interpreting the local scene to handicapped visitors would be lost, and there would be unnecessary disturbance of additional terrain.

## **LAS VENTANAS**

Reconciling the apparent inconsistency between legislative intent for public enjoyment of Las Ventanas and protection of American Indian interests in the area was a particular challenge. Although Las Ventanas is one of the resources specifically mentioned as a reason for establishing the monument, the legislation also directs that consideration be given to American Indians for access to sites for traditional cultural and religious purposes. Las Ventanas has special significance to the Acoma Indians.

Not developing the site at all, even by trail, was considered; however, the site was one of the reasons for establishing the monument and it should have at least some minimal accessibility for visitors. Excavating the entire site, stabilizing it, and making it a “showcase” was also considered – but rejected because of the site’s significance to the Acoma. The preferred alternative is a compromise between these two extremes.

Paved or gravel access to the Las Ventanas site on a new road from NM 117 was also considered but rejected because it offers little resource protection and no control over access to the site. Also, a new road would disturb an area with high potential for archeological sites.

## **SANDSTONE BLUFFS OVERLOOK**

Consideration was given to a trail to the bottom of Sandstone Bluffs and the lava edge below the overlook. This option was rejected for two reasons: the trails could be seen from Sandstone Bluffs overlook and would detract from the view, and there is also the possibility that people would inadvertently trespass on nearby Acoma land.

Consideration was also given to interpreting the building foundation next to the Sandstone Bluffs

road. The structure may not be historic, and interpretation of the structure is probably not significant to the El Malpais story.

## **SOUTH BIG NARROWS**

This area was considered for a trail onto the lava. It was rejected because of the fragile biological resources in the area, its high potential as a resource natural area, and the lack of controllable access.

## NATURAL RESOURCES

### GEOGRAPHIC SETTING

El Malpais National Monument is in northwestern New Mexico and entirely within Cibola County. The monument lies between the Zuni Mountains on the west and the Cebollita Mesa highlands on the east. This area of 114,992 acres lies between state highways NM 117 and NM 53 south of the city of Grants. Elevations range from about 6,550 feet near the site of the proposed multiagency center to 8,372 feet at the summit of Cerro Bandera.

Approximately 95 percent of the monument is covered by lava flows. Named by early Spanish explorers, “El Malpais” means “the badlands” or “the bad country” and appropriately describes the dark volcanic landscape. The surfaces of the flows are rugged and contain a variety of plant and animal species. Density of the vegetation depends primarily on the age and surface characteristics of the lava. Soil is better developed on the older flows, and usually there is more vegetation there. The flows contain “kipukas” – outcrops of older rock surrounded by later lava flows. Many kipukas are relatively small, less than 5 acres; the largest, Hole-in-the-Wall, is more than 6,000 acres.

Outstanding volcanic features include cinder cones and other craters, spattercones, pressure ridges, and some of the most extensive lava tubes in the United States. (Refer to appendix M for definitions of common lava flow features.) Other outstanding features include light-colored sedimentary rock outcrops that contrast sharply with the dark lava. These include Mesita Blanca, an almost white limestone outcrop; La Vieja, a large sandstone pinnacle known for its “old woman” face-like feature; and the Sandstone Bluffs, part of the sandstone and rimrock country that stands above the eastern margin of the El Malpais lava flows.

The monument is bordered and largely surrounded by the 261,800-acre El Malpais National Conservation Area, which is administered by the Bureau of Land Management. The conservation area contains the Cebolla Wilderness Area (60,000 acres), the West Malpais Wilderness Area (38,210 acres), and the Chain of Craters Wilderness Study Area (17,468 acres). A small portion of the northern monument boundary adjoins the Cibola National

Forest, Mount Taylor District. The eastern boundary of the monument borders some of the lands owned by the Acoma Indians.

### CLIMATE

The monument is semiarid, with average annual precipitation estimated at about 10 inches. Most precipitation falls between July and September in the form of convective afternoon thundershowers. Snow is retained on north- and east-facing slopes during subfreezing periods from December through February. Prevailing winds are from the west and south.

### GEOLOGY

#### introduction to the Monument and Its Geology

El Malpais National Monument is nationally significant because of the lava flows that cover fully 95 percent of its surface. The legislation that authorized the monument refers to the “Grants Lava Flow,” which is understood to mean the numerous flows of the past million years that cover most of the monument and not just the flows that literally reached the Grants area. The flows and associated craters and cinder cones are an important scientific resource and strongly shape the direction of planning for El Malpais. Several of the younger flows have surface features that convincingly demonstrate the dynamics of fluid lava, and they contain long systems of subterranean tubes along their centers. This combination of surface features and lava tubes comprises one of the most interesting volcanic terrains on the continent.

The earliest flows and associated craters, in order of eruption, are at Cerro Encierro, Cerro Bandera and Cerro Rendija (see the Existing Conditions map). These flows, now eroded and obscured by vegetation, cover areas in the western half of the monument. The terrain covered by these earlier flows did not contain major valleys, and none of these flows extended as far east as McCarty's Valley (as did later flows).

Later flows and associated craters, which include the most recent eruptions in the monument, occurred in the following order: El Calderon and Lava Crater; Cerro Candelaria, Twin Crater and Lost Woman Crater; Hoya de Cibola (including the Braided Cave flow); Bandera Crater; and McCartys Crater. The flows from El Calderon, Lava Crater, Cerro Candelaria, and Hoya de Cibola are old enough to exhibit some erosion and well-developed vegetation compared to the rugged and barren volcanic landscapes of the two most recent flows that began at Bandera and McCartys craters. The later flows (described in this paragraph) differed from the earliest group of flows in that they flowed long distances from their sources in the northwestern part of the monument, first to the east and then north down McCartys Valley toward Grants.<sup>30</sup> Hikers who cross McCartys Valley on the Zuni-Acoma Trail see portions four of the five youngest flows of El Malpais National Monument. The geologic map by Maxwell (Geological Survey 1986) shows the distribution of all the rock formations, including lava flows of the El Malpais region.

The Bandera and McCartys flows, the most recent in the national monument, offer great potential for interpreting the detailed forms and textures of lava to the public. Portions of these flows are so close to main roads that access and development can be planned to show most of these features to visitors. Features of the Bandera flow in more remote areas can be seen by driving lower standard roads and by hiking, as proposed in the preferred alternative. (Features that will be seen by and interpreted to monument visitors are described later in this section.)

## Geographic and Tectonic Setting

El Malpais National Monument is at the southeastern edge of the Colorado Plateau, a large geographic province that covers more than 150,000 square miles in northwestern New Mexico, northern Arizona, southeastern Utah, and southwestern Colorado. The monument is in the Datil section of the plateau, which is extensively covered by lava rock (Geological Survey, Hunt 1956).

The monument is dominated by two major features: on the northwest by the Zuni uplift and on the east by benches and high mesas (culminating in the lava-capped Cebollita Mesa of the Acoma Reservation). McCartys Valley and its geographic extension to the south – North Plains – is a long, north-south physiographic “low” occupied by a major fault zone along the floor of the valley (Geological Survey, Maxwell 1986). This fault zone, with its west side down, seems to account for the valley and plain topography covered by the numerous young lava flows that comprise most of the national monument.

The Continental Divide lies mostly west of the national monument along the Chain of Craters, a long line of cinder cone volcanoes in the western part of the national conservation area. However, the extreme northwestern corner of the national monument does contain about 3 miles of the divide where it follows the rims of Cerro Bandera and adjacent Bandera Crater.

Most of the national monument is on the Atlantic side of the Continental Divide, where the drainage is eastward around the south end of the Zuni uplift and then northward along McCartys Valley into the Rio San Juan near Grants. The Rio San Juan flows eastward to join the Rio Puerco (which finally enters the Rio Grande). Within most of the monument, the drainage is “confused” because most precipitation falls on lava flows or on volcanic cinder that are either cavernous or porous; stream channels in this volcanic terrain are the exception rather than the rule. Much water is diverted to the subsurface and eventually emerges downvalley, miles from its source, as springs in small marshes along the Rio San Juan. Low points below the general surfaces of the lava flows, such as caves and “sinks,” contain seeps and springs, indicating the presence of water tables in the lower levels of the flows.

The Zuni uplift has been a geographic “high” for perhaps 200 million years. On its southeastern end adjacent to the northwestern part of the monument, it is in the shape of an enormous anticline (fold). The axis of this fold plunges southward beneath the surface of the monument where many of the older rocks have been buried by recent lava flows. The

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30. Flows from the Cerro Candelaria, Hoya de Cibola, and Bandera centers flowed only half-way down the valley, whereas flows from the El Calderon and McCartys centers reached present-day Grants and beyond.

area of the Zuni Mountains immediately north of the monument has been valuable economically for its fluorspar mines (Geological Survey, Goddard 1966). In addition, a high heat flow and other favorable factors have drawn attention to the potential of future geothermal energy sites in this southeastern section of the Zuni Mountains (Laughlin and West 1976).

## **Geologic Time and the Rocks of the Monument**

The age and origin of rocks within the boundaries of El Malpais National Monument represents discontinuous portions of a long geologic history over the past billion years, as summarized in the following table. Because 95 percent of the monument's surface is covered by young lava flows, and the natural resources in the area are dominated by these volcanic resources, only brief summary will be made of the older nonvolcanic rocks.

The southernmost exposures of Precambrian rock in the core of the Zuni uplift, represented by blocky outcrops of gneissic granite along NM 53, have not been dated by radiometric methods; they are likely to rank among the oldest rocks in New Mexico – possibly as old as the ancient granites and gneisses at the bottom of the Grand Canyon. Lying into McCartys Valley and on top of these ancient rocks are early Permian sandstones and limestones, which form hills in the **Bandera** area (such as Sandstone Ridge) and comprise the hill country of Cerritos de Jaspe (in the national conservation area). In contrast to these Permian formations exposed on the west side of McCartys Valley, the east side of the valley is dominated by younger sedimentary rock formed during the Jurassic and Cretaceous periods. In the national monument along NM 117, these tan to yellowish sandstones form the bench-and-cliff landscape at Las Ventanas and Sandstone Bluffs overlook and the kipukas south of Big Narrows.

## **The Shape and Material of Volcanoes in the Monument**

A volcano is any vent in the earth's crust through which gas and molten rock issue, and the shape may vary considerably depending on the chemical composition, gas content, temperature, and volume of the magma and the configuration of the vent.

Some earlier flows in the **Bandera** lava field erupted along long fissures and did not have the mountain-like forms popularly associated with volcanoes. The most common volcanic shape in the **Bandera** field is the cinder cone (typified by Twin and **Bandera** craters and the Chain of Craters volcanoes), in which gas in the rising magma explosively showered droplets of lava around a central vent and built up a circular rim of more or less loose cinders around it. A few of the cones also erupted liquid lava that rose in the crater and either broke through the weakened cinder walls or overtopped the crater and flowed down the outside flanks. In the unusual case of Lava Crater, a large portion of the cone was built up largely by lava without much addition of cinder.

The flow at McCartys Crater seems to be an example of a large lava flow erupted through a small vent, and there was not enough violent gaseous activity to build up a cone.

In a few cases in the El Malpais area, such as the early eruptions from Hoya de Cibola and Cerro Rendija, fluid lava poured out in all directions from central vents and built up very broad domelike forms called shield volcanoes.

## **The Most Recent Lava Flows and Their Accompanying Features**

**Bandera Crater and Flow.** The **Bandera** Crater area is the focus of the most intensive development proposed in the general management plan alternatives.

**Bandera Crater** – This crater and its associated 33-mile-long sequence of flows is the centerpiece of visitor activity in the national monument. Causey (1971, 27-29) notes that major red cinder eruptions produced the present volcanic cone (and gave **Bandera** its colorful contrasts compared to other craters in the area). He states that **Bandera** is the only cinder cone in the area that had a final eruption so violent that a deep crater was produced. The rim of the cone rises about 450 feet above its exterior surroundings and about 640 feet above the bottom of its inner crater floor. (The impressive viewpoint at the end of the existing trail into the crater is at the approximate vertical mid-point – 320 feet above the crater

**TABLE 7: GEOLOGIC TIME AND THE ROCKS OF EL MALPAIS NATIONAL MONUMENT**

<b>AGE</b>	<b>FORMATIONS/ TYPE OF ROCK</b>	<b>WHERE PRESENT IN NATIONAL MONUMENT</b>	<b>PERCENT SURFACE AREA OF NATIONAL MONUMENT</b>
Precambrian; the oldest rocks may be 1 billion years before present	Gneissic granite	Along NM 53 northeast of El Calderon; part of ancient core of the Zuni uplift	Far less than 1%
Early Permian, about 260 million years before present	Tan, gray, yellow, and red siltstone, sandstone, and limestone. Includes Abo and Yeso formations, Glorieta sandstone, and San Andres limestone.	South of NM 53 east and west of Cerro Candelaria and in other scattered locations in the western part of the monument.	About 2%
Middle Jurassic to late Cretaceous, about 150 to 65 million years before present	Tan and gray shale, sandstone, conglomerate, and minor limestone. Includes Mancos formation, and Tres Hermanos, Dakota, Zuni, and Entrada sandstones.	Along NM 117 corridor between the highway and McCartys lava flow. Forms Sandstone Bluffs overlook, the cliffs east of the Narrows, and kipukas south of Big Narrows.	About 3%
Quaternary to A.D. 700, the last 1 million years	Dark gray basalt flows and pyroclastic debris (cinders, spatter).	Covers most of monument. Consists of a) earlier flows confined largely to the western part of the monument, and associated with Cerro Encierro, Cerro Bandera, and Cerro Rendija, and b) later flows tending to flow east and north associated with El Calderon, Cerro Candelaria and Twin craters, Hoya de Cibola, Bandera Crater, and McCartys Crater	About 95%

floor). Most of the surface material in the cone is loose cinder, although layers of coarse material (agglutinate and lava) are also present. During the later eruptions that built up most of the cone, fragments of semifluid lava were ejected from the crater along with cinders, forming the volcanic bombs that are part of the deposits covering the land north and east of Bandera Crater. Some of these bombs are unusual, containing angular pieces of olivine gabbro from deep in the earth's mantle, and are particularly interesting to geologists studying the origin of continental basaltic rocks (Laughlin et al. 1972, 1548).

Geologists have long speculated about the source and chemistry of magma deep in the earth's crust and the significance of the Bandera area lavas in the evolution of this portion of the continent (Hatheway and Herring 1970; Laughlin and West 1976; Laughlin et al. 1972; Geological Survey, Luedke and Smith 1978). The sequence of eruptions at El Malpais and the chemistry of the lava will continue to be important research subjects in the future of the national monument. (See appendix N for more detail on these subjects.)

**Bandera Flow**<sup>31</sup> -What sets this flow apart from others of basaltic composition in the United States is not its volume or extent, which are exceeded in several instances, but rather two unusual sets of features.

First, the Bandera flow also contains what is probably the most extensive series of lava tubes – in a sense a vast “central plumbing system” – probably not exceeded in total length by any other such system in a single lava flow in the United States. The main Bandera tube system, some 16 miles long, contains individual tubes up to 7,000 feet long, with long subterranean sections and with many branches that add miles to the main 16 miles.<sup>32</sup>

Second, between 7,400 and 7,900 feet, the Bandera flow contains an unusually large number of ice caves and large volumes of ice within its lava tubes, possibly more subterranean ice than anywhere else in the contiguous western United States – and it is remarkable that this phenomenon occurs so far south.

Carlton (NPS 1988b and 1989a) inventoried the surface features in the upper 14 miles of the Bandera flow. The following six types of surface features are obvious in these reports as the best examples in El Malpais that can be easily seen and interpreted to the public in accessible portions of the Bandera flow (see appendix M for definitions):

- . spattercones
- . tree molds
- . lava surface tubes
- . the huge volcanic canyon below the mouth of Bandera Crater, which is at the head of the Bandera tube system

- . numerous pahoehoe, aa, and blocky flows in juxtaposition
- . spectacular examples of aa flows that overwhelmed pahoehoe terrain including collapse structures

When these features are added to the lava tubes, ice caves, and the diverse crater landforms of the Bandera flow, the Bandera Crater area emerges as the best overall place in the monument to interpret volcanic geology. Farther south on the Bandera flow, the East Rendija area with its massive collapses (including lava bridges) and its large continuous lava tubes (including windows, smooth floor sections, and falling-lava-level phenomena) is a close second to the Bandera Crater area.

**Bandera Flow Lava Tubes** – The most thorough analysis of lava tube formation in the Bandera lava field is that of Hatheway and Herring (1970), who concentrate mainly on the flows and tubes within the boundary of the present national monument. They state that the tubes of the Bandera Flow “represent the best-preserved and most concentrated group of tubes yet described,” that “groups of tubes as extensive as these are not common,” and that “smaller systems have been reported in the western United States, Alaska, Hawaii, Australia, Iceland, and in East Africa” (1970, 311). Hatheway and Herring believe that the Bandera tube system, which extends about 16 miles down valley from the crater, is common to three nearly simultaneous flow units or surges of lava. There is some uncertainty how this vast “plumbing system” functioned, but the result was one of the great lava tube systems of the world in terms of length and complexity.

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31. A radiometric date from an early lava flow at the base of Bandera Crater is approximately 188,000 years (Laughlin and West 1976, 5; and Geological Survey, Luedke and Smith 1978); however, based on a comparison of weathering of other flows in the Bandera field, some geologists believe that the main flows from Bandera Crater are more on the order of 10,000 years, or even younger (New *Mexico Geological Society Guidebook*, Laughlin et al. 1982, 283).
32. The origin of this tube system is complex but believed to be common to three pahoehoe units that flowed in virtually simultaneous progression (Hatheway and Herring 1970, 310), thus it can be considered a system belonging to a single flow.

In 1988 the National Park Service contracted Kent Carlton to inventory the natural resources of the lava tube systems of the national monument. His study concentrated on the **Bandera** tube system (see appendix N for further information). Carlton found that although less than 20 percent of the system is in the form of open caves than actually can be entered, the alternating sequences of subterranean passages, “windows,” and open collapse structures greatly varies the exploration experience along the tube system and contrasts with other such lava tube systems in the national park system.

Carlton found three main types of features associated with the **Bandera** tube system:

**Lava tubes.** The **Bandera** flow contains most of the monument’s “big caves.” These are of many widths and floor-to-ceiling heights throughout the explored part of the system, with the largest recorded dimensions (in separate caves) being 70 feet wide and more than 50 feet high. One single tube has sections 60 feet wide and 50 feet high. The longest continuous, unbroken passage is more than 3,000 feet. The longest known cave in the national monument – nearly 7,000 feet – is “punctuated” by seven short “windows” (ranging from only a few feet to 200 feet long). In some “subway” tubes with classic circular cross section, there are many passages that branch off the main passage and rejoin it. Some show so many rejoining branches that these caves are termed “braided.” Some caves have two parallel passages for long distances. In some sections of caves, or in adjacent collapse structures, three, four, even five tubes may join in short distances. Others exhibit a phenomenon of tubes at different levels – “stacked” systems, with two, even three tubes on top of each other.

In many of the tubes with smooth walls, “dripping lava” phenomena are strikingly beautiful. These include colorful “lavacicles” up to 2 or 3 inches long that hang from the ceilings and walls (formed from coalescing molten droplets of lava

when the tube was still hot). On cave floors in a few places, lava “stalagmites” up to 2 feet high were built up as molten lava dripped off the ceiling above. Some smooth cave ceilings and walls are cracked into intriguing mosaics of panels – red, orange, brown, black, and white, sometimes in stark contrast to one another – and in some respects looking like abstract paintings. In some caves “silver formations” stand out in sparkling jewel-like radiance; these surfaces are composed of surface droplets of water and layers of white calcium carbonate.

**Collapse structures.** Numerous segments of the **Bandera** tubes subsided or collapsed entirely during or shortly after the flow cooled. Undoubtedly, collapses have continued to the present on a smaller scale. The large collapse structures form major chasms up to 100 feet deep that extend great distances down the axis of the flow. The walls of many are abrupt, forming cliffs and even overhangs. Most are floored with irregular piles of angular rubble. The **Bandera** flow at East Rendija has the longest sections of subsidence, containing not only sheer-walled collapses but also areas where the hot surfaces merely sagged. One large sinuous collapse here has conspicuous twists and turns (Caterpillar Collapse); another has such continuous sheer walls that it has a striking “box canyon” configuration; yet another is 3,000 feet long and has seven natural bridges spanning it (Seven-Bridge Sink). Lava bridges are fairly common in the collapsed areas of the **Bandera** tube system; the longest is about 200 feet along the tube axis, and many are shorter and quite picturesque.

The largest subsidence feature in the **Bandera** system, Hoya de Cibola, is a long rubble-filled gash, 1,200 feet long, 500 feet wide, and 100 feet deep; the other massive pit is Hoya de Diablo, 800 feet long, 250 feet wide, and 60 feet deep. These enormous subsidence features seem to be sites of local widening and deepening of a lava tube

segment – or perhaps places where several parallel tubes collapsed in mass.

**Ice caves.** The greatest number – many dozens – are in tubes and crevices in the upper and higher elevation portions of the system in the vicinity of Bandera Crater. Many cannot be entered because their passages appear to be entirely choked with ice. Lower sections of the Bandera tube system also contain caves with ice, and few are among the monument's most important ice caves.

**McCartys Crater and Flow.** McCartys Crater, in the southeastern portion of the national monument, is striking because although small, it extruded an expanse of lava nearly 35 miles long, a volume of 1.7 cubic miles. The lava that erupted from the crater flowed northward along the east side of McCartys Valley for miles before it encountered the valley of the Rio San Jose, where it turned abruptly east and flowed a few more miles before ending. (Present-day I-40 outside the national monument and conservation area cuts through this interesting terminus of the McCartys flow.)

The low degree of weathering and sparse vegetation on the McCartys flow attest its being the youngest lava flow in the national monument; however, it has not been dated radiometrically. Crumpler (New Mexico Geological Society Guidebook, Crumpler 1982c, 293) notes that the flow was in existence at the time of the Coronado Expedition in 1540 and that Darton (1915) recorded Indian legends about a river of fire along the Rio San Jose that buried prehistoric fields. Nichols (1946, 1056) indicates that Pueblo I potsherds were found well below the surface of alluvium near Laguna, which is similar to the alluvium covered by the flow terminus at McCartys. This suggests the flow may have occurred during early Anasazi occupancy of the valley, and therefore the McCartys flow is tentatively dated at A.D. 700 or younger (Geological Survey, Luedke and Smith 1978).

The McCartys flow, perhaps the youngest in New Mexico, differs greatly from the Bandera flow in several ways. The McCartys has extremely fresh pahoehoe lava surfaces with a "poured-out-yesterday" look and sparse vegetation, including many early-generation trees that are dwarfed and twisted. In general it lacks lava tubes (and, of

course, ice caves). Spattercones are also generally absent except for a field of 32 spattercones near the La Vieja area. Most examples of surface tubes are also absent.

Nichols (1938, 1939, and 1946) inventoried many of the surface features of the McCartys flow. Outstanding features that are the best examples in El Malpais include

- squeeze-ups
- spectacular pressure ridges (transverse and longitudinal), some of which are sinuous
- a variety of pahoehoe phenomena that are obvious reminders of the fluidity and plastic character of the flow surfaces: broad swells; surface blisters; circular and ovate sags, sinks, pits, and other collapse features; ropy surfaces; and diverse examples of lava breaking out of fissures onto the flow surfaces

Although the edge of the lava flow parallels parts of NM 117 and could be reached in a relatively short distance from the roads, some of the flow areas have fragile soils and sensitive plant communities, and other areas are special to the Acoma Indians. Only one small area (at the Narrows) affords a suitable opportunity for visitor exploration of these interesting lava surfaces.

**Other Flows in the National Monument.** There are several flows within the monument other than the Bandera flow.

**Lava Crater Flows** – The tube system in this series of flows contains some of El Malpais' most impressive lava and ice caves, particularly in the steep upper portions below the crater. In overall cross-sectional proportion, Dripping Lava Cave may be the largest tube in the national monument. The first 500 feet contains floor-to-ceiling heights of 70 feet and widths of 50 feet, and the tube descends at a steep angle to its terminus 1,200 feet from the entrance; the end may be farther below the surface than any tube in the monument. The cave contains colorful ceiling sections and a perennial ice pond. Downslope from Dripping Lava Cave, a tributary aa flow from the Bandera flow covers the Lava Crater tube system, and there is evidence that the younger lava overwhelmed and filled tubes in the older tube system.

**El Calderon Flows** – This impressive system begins at the mouth of El Calderon’s crater as an open, canyonlike open channel filled with rubble. Lower sections, including subterranean portions, split into two long tube systems. One system contains numerous sinks, including the pitlike Double Sinks (more than 60 feet deep and separated by a thick lava bridge) and the 3,000-foot-long Junction Cave, which is the only tube in El Malpais showing evidence of flooding by water. The other system contains a collapse structure that opens into a west tube (cold and containing beautiful lava dripstone) and an east tube (Bat Cave, which is the warm-weather habitat of a large colony of Mexican free-tailed bats numbering in the thousands).

**Twin Crater Flows** – This system is lengthy but not very impressive. It has a few sinks, a bridge, and some small accessible caves, but it is very difficult to identify on the ground because it has only a slight discontinuous sag rather than many collapse structures. The tubes may have unusually thick roofs, which keeps the system largely inaccessible.

**Cerro Rendija Flows** – Cerro Rendija is a small shield volcano (2 miles in diameter) just outside the west boundary of the national monument. Its two known tube systems are not rich in caves, although some of the crevices are deep and contain ice. Fern Sink, the monument’s most impressive circular collapse structure (100 feet in diameter, 75 feet deep) is part of the system. The lower sections of the system appear to have been entirely overrun by the younger Bandera flow. To reduce confusion, it should be understood that the “East Rendija” tubes of the Bandera lava flow as described elsewhere are east of Cerro Rendija and are not part of the Cerro Rendija tube systems described here.

**Hoya de Cibola Flows** – Flows of the older Hoya de Cibola eruptive center contain impressive lava tubes and collapse features. Hoya de Cibola, an extremely large subsidence pit, is 2,000 feet long, 650 feet wide, and more than 100 feet deep. The caves in the system are of surprising size and length as well as great beauty. Five of the six explored caves contain such features as

smooth “subway” tunnels, sections of “stacked” and parallel tubes, skylight windows, domed ceilings, areas of intensely red color, and cross-sectional dimensions with heights up to 30 feet and widths up to 50 feet. The sixth cave, Braided Cave, is among El Malpais’ longest. Not only does it have numerous branching tubes with intervening pillars and smooth floors, but its dripping lava formations are among the most colorful in the monument.

**Other Flows** – Flows originating from other eruptive centers in the monument, including Cerro Bandera and Lost Woman Crater, did not have the type of lava or other characteristics such as proper gradient to form extensive lava tubes. It is also important to note that the known tube systems have not been thoroughly explored, including the lower 2 miles of the Bandera system.

## PALEONTOLOGY

The monument has not been surveyed for paleontological resources. There is potential for fossil resources in certain formations in the monument such as the Dakota sandstone, Mancos shale, and San Andres limestone. Elsewhere, these formations are known to contain fossilized marine invertebrates and plants.

## MINERALS

Areas in the larger region are being developed for energy resources including coal, uranium, natural gas, oil, and geothermal steam. However, a preliminary report indicates that there are no major significant mineral or energy resources within the monument (Geological Survey, Bigsby and Maxwell 1981).

Deposits of basalt and cinder are common in the monument. There are three open-pit cinder mines in the northeastern part of the monument; one of these is still actively mined and the other two are inactive. The monument also contains a 25-acre borrow pit (inactive) and an old sandstone quarry. These pits are a visual intrusion, and the mining of cinders is a loss of volcanic resources. Because the mines are on private lands, no action can presently

be taken by the Park Service to close or reclaim them.

Some of the lava tubes contain small clusters of unusual and delicate minerals, including trona, burkeite, and thenudite. The extent of these deposits is unknown.

## SOILS

The surfaces of the most recent volcanic flows have little or no soil. Soils that have accumulated are primarily wind-blown deposits, varying from shallow in crevices to deep where there are small fans and playas along the edge of the lava flows. In older flow areas, such as El Calderon and Lava Crater, there is a definite soil profile -thin and stony. Most soils on the lava areas have good drainage, are not highly erodible, and are well suited for facility development. Mound sanitary discharge systems may be required where soils are shallow.

Soils along the monument's eastern boundary are derived largely from sandstone and shale. Whereas soils on the bluffs are generally shallow, which limits vegetation composition and density, soils at the base of bluffs are loose silt and sand eroded from the cliffs above. All these sandy soils are unstable and highly erodible, which limits facility and recreation potential. However, soils in areas such as Sandstone Bluffs could be stabilized with engineering fabric and base aggregate.

## VEGETATION

A vegetation study for the monument and conservation area was recently completed by the Bureau of Land Management. This study, conducted by remote sensing methods, identified eight major vegetation classes and numerous subclasses in the monument. The major vegetation classes are as follows:

**Lava** (approximately 35 percent of monument surface area) - The lava vegetation class is found primarily in the eastern and northwestern portions of the monument. Cracks, crevices, and small depressions within the lava contain tree species such as ponderosa and pinon pine and juniper. However, with limited area for root expansion, trees tend to be stunted, twisted, and

contorted. Shrubs and grasses in the lava flows include Apacheplume, New Mexico privet, current, oak, rabbitbrush, California brickellbush, skunkbush sumac, Wright sagewort, rough golden aster, wax currant, and blue grama. Forbs include many composites and mint species. There are also numerous cactii, but not all species have been identified. Lichens are well represented, with more than 70 species known. Fragile moss-lichen-fern plant communities grow at the entrances to the caves and below the larger lava tube windows. Additionally, ice water algae communities are found in some of the caves.

**Sparse/bare** (approximately 5 percent) - This class, characterized by exposed rock or soil with grass clumps and low scattered shrubs and forbs, is found mainly along the eastern edge of the monument. Grasses include blue grama, galleta, and other warm season species. Typical forbs include kochia, composites, and sunflowers, which cover large areas and are a significant source of seed for birds. Western wheat grass is dominant in playas.

**Grass/shrub** (approximately 5 percent) - As with the sparse bare vegetation class, the grass/shrub class is also common along the eastern edge of the monument. This class is characterized by blue grama in sod interspersed with forbs, mixed grasses, and shrubs such as horsebrush, sage, snakeweed, and rabbitbrush. There are scattered areas of pinon and juniper.

**Shrub/conifer** (approximately 5 percent) - This class is open mixed conifer with a grass-shrub understory. At lower elevations (6,800 to 7,600 feet) and on south-facing slopes, shrub/conifer is typically a mixture of pinon/juniper with an understory of blue grama, rabbitbrush, snakeweed, current, rhus, horsebrush, and other grasses and forbs. As elevation increases, and on north-facing slopes, ponderosa pine becomes common. Alligator bark juniper is also common. Oak in the understory provides excellent deer habitat. In and around Bandera Crater, Douglas fir is part of the conifer complex.

**Mixed conifer** (approximately 45 percent) - This is the most widespread class and is common in the central, northern, and western portions of the monument. The mixed conifer class contains the same species as described in shrub/conifer except the forested areas are denser and interspersed with small meadows. Some areas included contain mature trees with an understory of young trees of the same species, as well as the typical grass/shrub understory.

**Pinon juniper woodland** (approximately 1 percent) - This class is patchy and covers only small areas. It is characterized by a thick growth of mature pinon pine and juniper trees. Scattered ponderosa pines also occur.

**Deciduous** (approximately 2 percent) - Characterized by stands of oak and groves of aspen, this class creates an edge effect along the lava margins. In some places, deep, moist soils contain unusually large oak trees. Although the deciduous class is very small overall, it is of special management concern because of the important wildlife habitat associated with it.

**Ponderosa parkland** (approximately 2 percent) - This class is composed of climax stands of ponderosa pine interspersed with grassy meadows. The understory is typically June grass, mountain muhly, mutton bluegrass, and grama. This class is maintained by regularly occurring natural wildfires.

In addition to these eight principal vegetation classes, there are a number of smaller unusual and easily disturbed vegetative communities and species, some of which were described briefly above. More detail follows.

Almost all flow edges, even if only a few feet high, are zones where water collects and provides moist growing conditions. These narrow zones, called lava-edge ecotones, contain many trees, shrubs, and forbs in unusual density. These ecotones are rich in vegetative and wildlife diversity and are aesthetically attractive to visitors.

In the east-central portion of the **McCartys** lava flow are scattered stands of dwarfed ponderosa pine. Because of severe growing conditions, these trees

are stunted, twisted, and contorted into bizarre shapes. Some of these pygmy pines may be hundreds of years old.

Limber pine have been found on only one of the monument's craters. Although not an unusual species in the region, this is the only known occurrence in the monument.

Sensitive moss-fern-lichen communities are found primarily near cave entrances and windows, and ice water algae communities are found in some ice caves. These plant communities are sensitive to disturbance, and the potential for adverse impacts is high because of the popularity of caves. Two New Mexico sensitive plant species, the grass fern (*Asplenium septentrionale*) and maidenhair spleenwort (*Asplenium trichomanes*), have been found in the monument. Lichen species are numerous. One study (DeBruin 1984) identified 75 lichen species along NM 117, including four uncommon species.

One of the types of cactus of particular concern is the hedgehog, which is abundant on the lava. Young plants are difficult to see and highly vulnerable to trampling. The mature hedgehog is popular with cactus collectors.

Because many of the monument's kipukas are isolated by rugged lava they are relatively undisturbed. In certain kipukas vegetation is as close to the original biotic condition as anywhere in the entire El Malpais region. Big and little **bluestem** and Arizona fescue grasses occur there in virtually undisturbed stands. Kipukas made of calcium rich rock may support unusual plant associations and perhaps even endemic species. One such area is **Mesita Blanca**, a kipuka of San Andres limestone, which has not yet been inventoried. Other rare or unique plant associations or species also may be discovered.

Inverted lifezones also occur in the monument. These exhibit such relationships as aspen growing at lower elevations than pinyons and junipers.

The sparse bare and grass/shrub vegetation class areas have been and are still used for grazing of livestock. Impacts on native vegetation and wildlife are not well documented. Exotic species such as Russian thistle, cheatgrass, kochia (chickweed), crested wheatgrass, and alfalfa appear to be well established.

## WILDLIFE

The lava fields and adjacent forests and shrublands are habitat for approximately 150 species of wildlife. The lack of permanent water limits wildlife numbers, and the rugged lava rock restricts wildlife movement. Before establishment of the monument, hunting, trapping, and predator control techniques were used to manage certain wildlife species. Under the legislation establishing El Malpais National Monument, all public hunting, trapping, and predator control is now prohibited.

Common avian species include Steller, scrub, and pinyon jay; robin; mourning dove; downy and ladder-backed woodpecker; rock wren; white-breasted nuthatch; mountain and western bluebird; rufous hummingbird; horned lark; western meadowlark; cliff swallow; mountain chickadee; and scaled quail. There are also kestrel, prairie, goshawk, red-tailed, Cooper's, and rough-legged hawks, and great horned, pygmy, long-eared, and burrowing owls. Golden and bald eagles sometimes forage in the monument. The sandstone cliffs along the eastern side of the monument provide raptor nesting habitat. Raptor nesting has been declining in recent years, but the reasons are unknown. The turkey vulture and common raven also use the cliffs. Wild turkeys have been observed in the northwestern part of the monument.

Common mammalian species include mule deer, porcupine, striped and hog-nosed skunk, long-tailed weasel, black-tailed jackrabbit, desert and mountain cottontail, and a variety of rodents. Areas of deep soil along the monument's eastern boundary are habitat for the Zuni prairie dog. The most common predator is the coyote, but black bear, mountain lion, badger, long-tailed weasel, gray fox, and bobcat are occasionally seen. Pronghorn use the area south of the Laguna flow. Elk are occasionally seen in the higher elevations of the northwestern part of the monument.

The monument provides summer and winter habitat for a variety of bats including Mexican free-tailed, Townsend's big-eared, hoary, pallid, big brown, and several myotis including long-eared, fringed, long-legged, and small-footed. The monument may also contain habitat for silver-haired, big brown, and spotted bats. There are several bat caves and colonies in the monument, but by far the most popular is the one near El Calderon where the

summer Mexican free-tailed bat colony has been estimated at 6 to 8 thousand.

Monument reptiles and amphibians include the black-tailed, western diamondback, and prairie rattlesnake; western black-necked and western terrestrial garter snake; bull snake; mountain patch-nosed snake; regal ringneck snake; night snake; tiger salamander; and a variety of lizards, toads, and frogs. Habitat for frogs, salamanders, and some toads is restricted to playas, stock ponds, small springs, and other permanent sources of water, which are limited. Some of the mammals and reptiles have melanistic characteristics.

The monument supports no fish species.

Extirpated species include the gray wolf (*Canis lupus linnaeus*) and bighorn sheep (*Ovis canadensis*).

## THREATENED AND ENDANGERED SPECIES

A threatened, endangered, and rare plant survey (New Mexico Dept. of Natural Resources, Spellenberg 1979) concluded there are no state or federal threatened or endangered plant species in areas now part of El Malpais National Monument. Representative regional habitats were surveyed, with "high potential" sites particularly well covered. Surveyed areas included Quaternary and Tertiary lava flows, cinder cones, sandstone "islands" (kipukas), and areas adjacent to El Malpais. The survey recommended a second inventory be performed late in the season to document the presence or absence of certain late-flowering species. However, it was doubted that any of the late-flowering species would be present because of lack of adequate habitat.

The U.S. Fish and Wildlife Service identified the endangered American peregrine falcon (*Falco peregrinus anatum*) as the only federally listed threatened and endangered species to potentially occur in the monument. In addition to the peregrine falcon, there have been three recent documented sightings of the federally listed endangered bald eagle (*Haliaeetus leucocephalus*). The bald eagle is believed to use the monument only as a migrant, but could also be a winter resident. The monument is not considered critical habitat for the bald eagle because of the lack of aquatic resources. The New Mexico Department of Game and Fish has also

identified the federally listed endangered black-footed ferret (*Mustela nigripes*) as formerly occurring in the area. The state also identified nine species that are on the federal notice of review list, including the following:

- Townsend's big-eared bat (*Plecotus townsendi*) - winter resident
- white-faced ibis (*Phalacrocorax olivaceus*) - migrant
- Swainson's hawk (*Buteo swainsoni*) - migrant
- ferruginous hawk (*Buteo regalis*) - migrant/breeder
- spotted bat (*Euderma maculata*) - on nearby Mt. Taylor
- mountain plover (*Charadrius montanus*) - breeds in the nearby North Plains area
- long-billed curlew (*Numenius americanus*) - migrant
- "western" yellow-billed cuckoo (*Coccyzus americanus occidentalis*) - migrant
- "southern" spotted owl (*Strix occidentalis lucida*) - resident in the nearby Zuni Mountains

Because most of these species are migrating through the area, they will probably not pose much limitation on management of the monument.

Although federal notice of review species do not have legal status, if these animals are found in the monument protection will be provided until their status is determined by the U.S. Fish and Wildlife Service. Protective measures would include identification, monitoring, and habitat protection.

## GRAZED LANDS

Grazing of livestock has been an important source of income in the region for the past 150 years. The rough lava terrain restricts livestock movement. The legislation establishing El Malpais National Monument allows the continuation of grazing until December 31, 1997. The impacts of grazing on native flora and fauna have not yet been evaluated.

Several rangeland developments in the monument, primarily along the periphery, consist of earthen and metal stock tanks, barbed wire fences, corrals, one windmill, and buried plastic water pipelines. Livestock operators occasionally use motorized vehicles and equipment to maintain these developments.

## WATER RESOURCES

El Malpais National Monument is just east of the Continental Divide in a closed hydrologic basin known as the North Plains and the Malpais Lava Beds. Although the surface of the monument is noted for its lack of water, water does occur in isolated sinks and caves and supports certain ecological and aesthetic values of the monument.

Stream flows last only for short periods in response to infrequent rainstorms and snowmelt. Storm waters collect in depressed areas as ephemeral pools. These pools occur both on the surface of the lava flows and in low areas dammed by the lava flows. The ponding of surface water only temporarily indicates that recharge to ground water occurs. Although not well understood, this interaction between surface and ground water is likely an important natural process in the lava flow environment.

The northern part of the monument is in the Bluewater Ground Water Basin, and the southern portion is in the Rio Grande Ground Water Basin. The ruggedness of the lava landscape historically restricted human occupation, including the development of ground water. Because of this, information on ground water resources is very limited. Successful wells are along the periphery of the monument beyond the margins of the lava flows. These wells generally provide only small volumes of water for domestic and stock use. The wells tap water from alluvium or thin aquifers and produce about 5 to 10 gallons per minute.

The San Andres-Glorieta aquifer, about 500 feet below many areas, is the major subsurface source of water. This aquifer is in consolidated sedimentary rocks beneath alluvium and basalt. Several wells outside the monument draw water from the San Andres, but development of wells this deep is expensive.

Other potential sources of ground water are at the base of the basalt flows, which appear to be sufficiently fractured to act as an aquifer. However, where penetrated by wells, many of these sites have been dry.

The availability of ground water for monument use is still uncertain. Further studies of the geology and hydrology, especially the Bandera Crater area, are needed. A preliminary analysis by the NPS Water

Resources Division of the Washington Office concluded that the potential for low yield wells (5-10 gallons per minute) for proposed facilities along the eastern monument boundary is fair to poor. The underlying Chinle Formation is noted for both very low yield and inferior water quality. Obtaining adequate ground water supplies for the proposed Bandera development is speculative, but nonetheless will be attempted by means of test wells prior to further planning for facilities.

## **FLOODPLAINS AND WETLANDS**

Analysis of the monument by the NPS Water Resources Division of the Washington Office identified only one floodplain – in the southern part of the multiagency center site near Grants. However, the proposed boundary change in this area will remove this floodplain from the monument.

Most of the monument is covered by porous, fractured lava that absorbs most rainfall. Areas immediately adjacent to the margins of the lava flows are subject to temporary ponding during heavy rain and are probably not suitable for development of facilities. Most proposed development sites are in well drained areas or near the head of watersheds that are not subject to dangerous flooding.

Because of the lack of water, the monument does not contain any wetlands. There are wetlands adjacent to the monument, including Ojo del Gallo spring near San Rafael and the lava-edge ponds along I-40. The temporary ponding of water along lava flow margins does not trap enough moisture to support hydrophilic (wetland) vegetation.

## **AGRICULTURAL LANDS**

There are no prime or unique agricultural lands in the monument.

## **AIR QUALITY**

El Malpais National Monument is designated a class II area under the 1977 Clean Air Act (42 U.S.C. 7401 et seq.). Because of the lack of specific monitoring, it is unknown whether standards of that designation are being met within the monument. However, because of its rural

location and because the air in Cibola County meets or exceeds the national ambient air quality standards, the quality of air in the monument appears to be good to excellent. There are, however, short periods of regional haze. Several lichen species are extremely vulnerable to pollutants; a 1984 study found no indication that lichen at El Malpais were being affected by pollutants at that time (DeBruin 1984). Prevailing winds are from the west and south.

Air quality and air quality related values (AQRVs) are extremely important monument resources – vital to protection of other sensitive resources in the monument and also to visitor use and the interpretive story.

Regional energy development, both planned and existing, may be a threat to air quality because of reduced visibility and increased SO<sub>2</sub> levels. Energy-related development includes coal-burning power plants, strip mining, uranium mining, heavy truck traffic, and increased urbanization. There are no major sources of air pollution in the immediate vicinity of the monument; however, there are major sources of pollution in the region. These include coal-fired power plants at Thoreau, New Mexico (approximately 50 miles away, which burns approximately one million tons of coal per year), Farmington, New Mexico (125 miles away), and Holbrook, Arizona (175 miles away). Construction of a second 233 megawatt coal-fired power plant near Thoreau is being considered. The proposed Bisti coal-fired power plant, about 85 miles north of El Malpais (near Chaco Culture National Historical Park), could also have an adverse impact on the monument's resources if it is constructed.

Mining, another potential source of pollution, is a major economic activity in western New Mexico. The uranium mining around Grants, a possible source of particulate matter, is essentially shut down. The nearest copper smelter is in Hurley, New Mexico, 165 miles southwest of the monument. Other smelters are in El Paso, Texas, southeastern Arizona, and northern Mexico. The El Malpais region contains several large coal fields, and increased energy development in the region could diminish the existing air quality.

## **VISUAL QUALITY**

Air quality affects the clarity of views of distant landscape features, as discussed above. Land management practices outside the monument also affect the landscape itself. Mines, roads, and powerlines affect monument viewsheds.

Visual quality of the distant landscapes that form the backdrop of the major monument features is very important to the visitor experience. Some of these features are described in the “Affected Environment” section (under “Geographic Setting”). Many of these features could become obscured on certain days if air quality standards are not protected.

Within the monument, shrublands and forested areas along the lava margins contain most of the visual evidence of human use and development. These areas have been heavily grazed and timbered and some contain important transportation corridors. The monument also contains three cinder pits, a 25-acre borrow pit, and an old sandstone quarry – major visual intrusions.

## **AUDIO QUALITY**

Natural quiet is an aesthetic resource that greatly contributes to a visitor’s sense of solitude and serenity. With limited regional development and human occupation, El Malpais provides the visitor with this important resource. However, activities such as overflights, particularly military low-level flights, encroaching development, and increased vehicular traffic threaten this value. Excessive “noise” can diminish a visitor’s overall experience and negatively impact fragile wildlife species. Protection of monument “quietness” will include NPS participation in regional planning and development activities and consultation with other agencies to limit activities such as overflights.

## CULTURAL RESOURCES

The Southwest is rich in cultural resources, ranging from spectacular cliff dwellings and massive pueblo ruins to small, unobtrusive scatters of potsherds and chipped stone. Some of these remains can be traced through time to the contemporary tribes who still occupy these lands. The region's cultural resources also include Spanish colonial, Mexican, and Mormon settlements along with a variety of early ranching, farming, mining, and logging sites. All the resources document a continuum of over 10,000 years of human history in a region where great ecologic and scenic diversity has helped shape human adaptation and change. Many of these resources are unique to the El Malpais and are a vast storehouse of valuable scientific and historical data.

A brief summary of the area's prehistoric and historic archeological resources is given in the following sections.

### PREHISTORIC ARCHEOLOGICAL RESOURCES

The continuum of human occupation in the El Malpais area began some 10,000 to 12,000 years before present and continues unabated to this day.<sup>33</sup> Scientists think the very earliest Paleolithic hunters subsisted, in part, by hunting large, now-extinct animals. Only a few scattered traces of these hunters – bone and stone tools, simple hearths, and the remains of the quarry they pursued – remain behind.

Over the next 10,000 years, the climate changed, many of the large mammals became extinct, and human cultures changed and adapted. Subsistence patterns gradually changed from big-game hunting to smaller game and then to seasonally scheduled gathering and hunting – a time known as the Archaic period. The later inception of horticulture and settled villages was accompanied by population increases and improved technologies.

The Basketmaker period (following the Archaic) is marked by the first appearances of plainware

pottery, the bow and arrow, and pit houses. By A.D. 500, these people, now known as the Anasazi, were present across all of northcentral and northwestern New Mexico. These farmers raised corn, beans, and squash, supplementing their diets by hunting and limited gathering.

Basketmaker sites occupied many different environmental settings, but many were in wide valley bottoms or on the higher sand hills. Storable food surpluses allowed increasingly larger groups of people to stay longer in one place, building permanent homes in villages.

By A.D. 800 (the beginning of the Pueblo I period), the Anasazi were living in semi-subterranean pit houses. These structures had stone foundations, jacal walls, and surface storage structures arranged around the pit houses in a crescent. These small pit houses were often built in narrow canyons near low cliffs. It is likely that increases in cultural complexity, political organization, religious activity, and trade accompanied the increasingly sedentary way of life, agriculture, and new technology. Fewer than 10 sites with components dating to this time have been documented in the monument.

Over the next 250 years, the Pueblo II period (approximately A.D. 950-i 100) communities made up of small villages spread throughout the area. Most were built on small benches or hills at the sides of canyons. The modest Anasazi pit houses were gradually replaced by rows or clusters of rectangular multifamily dwellings of poles and mud or stone slabs with adobe mortar. These surface rooms were aligned on a north-south axis with a plaza and kivas on the east. Within these roomblocks, special activity rooms were common. Many of the numerous pottery types from these sites appear intrusive, suggesting that these people may have been trading with or influenced by groups outside the region.

Elsewhere in the region, other major changes were underway. A large population center began to develop at Chaco Canyon sometime between A.D.

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33. With some exceptions, the following discussion was abstracted from the 1988 report on cultural prehistory of El Malpais by Ireland (NPS 1988a).

800 and A.D. 950. Eventually the influence of the Chaco Canyon culture spread outward to certain Anasazi villages – now known as Chacoan outliers.

By about A.D. 1050 these Anasazi had become part of the larger, integrated, highly organized, hierarchical, centralized socioeconomic and political system known as the Chaco Phenomenon. Chaco Canyon probably served as the central place for a core of institutions and highly ranked personnel. Some think it may have been the administrative, economic, and probably the ceremonial center of a complex Anasazi trading network, which included as many as 75 outliers. The larger Chacoan sites are characterized by large-scale construction activities, including monumental public architecture, large towns, and water control features.

An extensive system of wide, straight, beautifully engineered roads and associated signal stations extended across 150,00 to 300,000 square kilometers of the northern Southwest to connect the outlying villages to the central core of the system, Chaco Canyon.

Las Ventanas, 70 miles south of Chaco Canyon in El Malpais National Monument, is an important Chaco outlier dating to about A.D. 1150 to 1200 (Pueblo II and III periods). This archeological site, listed on the National Register of Historic Places, contains Chacoan structures such as a great kiva and a prehistoric roadway set in the midst of an Anasazi community.<sup>34</sup> The pueblo, now buried, has approximately 60 ground-floor rooms and perhaps as many as 30 upper-story rooms. Shaped basalt from the adjacent lava flows and sandstone from the surrounding cliffs was used for construction. The great kiva has four well-defined alcove rooms. A tower kiva, at least two stories high, is within the pueblo. The site's location near the edge of the lava flows, and some of its other characteristics, make it one of the more unusual of all the 75 or more outliers in the Chacoan region.

Large communities, growth in artistic development, and intensive local specialization in artifact manufacture are the hallmark of the late Pueblo III

period. Virtually all of the earlier sites in topographically higher settings were abandoned during this period, and large habitation sites were built near good farming soils at the mouths and in the broader portions of canyons or on the edge of plains. Later sites could be found on the flat-topped mesas in this area. Over time, there were slight changes in intra-village arrangement.

After about A.D. 1200, the number of Anasazi sites in the El Malpais region began to decrease. There was a general decline from the cultural acme of the Pueblo III period, suggesting a reorientation in economic and cultural affiliations. Numerous sites were abandoned during this period as peoples moved into a very few extremely large sites such as Acoma Pueblo itself, which may have been founded earlier. Glaze-type pottery was introduced during this period, and pottery types from the Hopi, Zuni, and the Rio Grande regions appear in sites near El Malpais, suggesting continued movement and cultural interaction. Several sites in the national conservation area are from this period.

Approximately 130 archeological sites have been recorded in the monument. Three-fourths of these are Anasazi, most dating to between A.D. 700 and A.D. 1300, especially from the Pueblo II and III periods. Ten Archaic and three Mogollon sites have been reported; most others are of undetermined cultural affiliation.

The archeological sites in El Malpais represent the continuum of use by a number of different cultures and are varied in type, period, location, and size. These sites are significant for a number of reasons. Those in El Malpais are often associated with special lava features, illustrating past human religious and subsistence activities. These sites can tell us of specialized use of environmental niches or of selected resources (such as ice) found only in certain areas and can elucidate the complex human adaptation to this rugged, arid landscape. Several different cultural groups used this area; related sites can illuminate past trading activities, economics, and cultural contact. El Malpais contains one of the southern-most Chacoan outliers and roadways –

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34. The description of Las Ventanas was taken from Marshall et al. 1979, 187-193.

important to the broader understanding of the entire Chacoan system.<sup>35</sup>

Sites range in size from a square meter to larger than 10,000 square meters; nearly half encompass more than 1,000 square meters. The varied site types and features include occasional rock art and small scatters of lithic and ceramic sherds; isolated structures such as field houses and jacal or masonry rooms; and pueblo villages with large roomblocks, kivas, middens, and storage areas. Half of the reported sites contain masonry rooms or roomblocks. Some prehistoric sites are important to contemporary American Indian groups.

Because of the focus of past archeological investigations, the majority of the sites reported for El Malpais are clustered in drainages away from the lava and along the eastern boundary of the monument, especially in the Las Ventanas area.

At the time of survey, about half these sites were reported as "intact" or in good condition; others, especially the large prehistoric sites, had been vandalized, had had mechanical disturbance, or were impacted by grazing. Because of ongoing erosion, pot-hunting, and other human use, it is likely that only a few of these sites are intact today. Only a handful of sites have been archeologically tested or excavated, or have curated collections.

Despite the richness and apparent uniqueness of the area's sites, only a very few have been evaluated for the National Register of Historic Places. The Las Ventanas site, also known as Candelaria Pueblo, was added to the National Register of Historic Places in 1983.

Descriptions and locations of archeological sites generally are not included in this general management plan for two reasons. First, because so little of the monument has been surveyed and existing data are inadequate, descriptions of known sites would present a misleading picture of the area's total cultural resources. Second, because resource protection is a primary focus of the plan for cultural resources, protection of site identity and locations until archeological work can be accomplished is vital.

## ETHNOGRAPHIC RESOURCES

Scholars have made arbitrary divisions in describing the continuum of human occupancy in the Southwest to accommodate the different research disciplines of archeology, anthropology, history, and cultural geography. This should not be so, for the continuum is a long and unbroken chain that links peoples, past and present, to the land. To quote a Taos Pueblo man –

We have lived upon this land from days beyond history's records, far past any living memory, deep into the time of legend. The story of my people and the story of this place are one single story. No man can think of us without thinking of this place (Henry et al. 1970, 35).

For thousands of years, the region has been home to many different American Indian groups. Prehistoric peoples and their descendants, including the modern-day Indians of the Acoma, Laguna, and Zuni pueblos, and the Ramah Navajo, have hunted, gathered, and worshipped here, building homes and shrines, and cultivating fields. The Pueblo peoples who now occupy the villages of Zuni, Acoma, and Laguna are descendants of the architects of Chaco Canyon, Mesa Verde, and other Anasazi places across the Southwest. In the face of rapid cultural change, the present-day pueblos have maintained lifeways tied to seasonal or cyclical ceremonials, retaining their "gentle and unobtrusive character, customs, institutions, and art forms" (Ortiz 1979, 1).

Over the past two centuries, history has changed the ways these peoples live upon the land. Large areas formerly used solely by Indians are now reduced to large blocks of land under private and government ownership. In creating the El Malpais National Monument/ National Conservation Area, lawmakers were acutely aware of these divisions and of the many concerns expressed by American Indian groups. The law reflects this awareness by providing for continued tribal use of El Malpais, ensuring that Indian peoples have nonexclusive access to monument and conservation area lands for traditional cultural and religious purposes.

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35. The New Mexico state plan now in preparation will identify specific themes and historic contexts relevant to the El Malpais area.

## Acoma Pueblo

Acoma peoples especially claim ancestral ties to the El Malpais area, citing prehistoric use of the Acoma Culture Province, an area that stretched roughly from the Rio Grande west to El Morro.

Although initial Spanish colonization and missionary efforts were focused mainly on pueblos in the Rio Grande Valley, the Spanish search for precious metals, their attempts to convert the Indians to Christianity, and their forceful seizure of tributes of food and clothing eventually led to conflict with the western pueblos of Zuni, Acoma, and Laguna as well. In 1598 the Spanish explorer Onate led an expedition to Acoma. Fifteen of his soldiers who were demanding tribute were killed, and in retribution the Spanish destroyed the pueblo and took 500 captives as slaves.

Within a few years, most of the captives had escaped and returned to rebuild the pueblo, and by 1630 the Acoma population was reported at 2,000 people. Historical documents cite year-round occupation of Acoma Pueblo and the seasonal use of farming villages in Cebolla, Cebollita, Paradise, and Locomotive canyons near El Malpais during the mid 1600s.

In 1680 the pueblo groups banded together in an attempt to drive out the Spanish. Survivors of this revolt against the Spanish scattered across northern New Mexico, seeking refuge among other pueblo groups, including the Acoma. Although this revolt loosened the Spanish hold on the Rio Grande pueblos for several decades, it was at a high cost to all native residents because of battle deaths, starvation, and disease. By the 1700s the Spanish felt that "the western Pueblos of Acoma and Zuni had offered their submission" (Simmons 1979, 187).

Over the next half century, incursions by Apache and Navajo groups drew the Spanish and the Pueblo peoples together, and eventually with this new alliance the pueblos began to recover a semblance of prosperity. During the late 1700s, large flocks of sheep were bred at Acoma, Laguna,

and Zuni, and the wool was used to produce fine blankets.

Today the Acoma occupy the farming villages of McCartys and Acomita. Families maintain homes in Acoma Pueblo for use during ceremonial observances, but most Acoma live elsewhere on the reservation. Guided tours of Acoma Pueblo, also known as Sky City, give visitors a chance to see their pottery and the site of their ancient pueblo.

Like many other present-day pueblo groups, the Acoma people maintain a close society, protecting the secrecy of their religious activities and their "right to keep the knowledge of the culture within" (Garcia-Mason 1979, 451). The location of Acoma Pueblo atop a high mesa reinforces this perception.

The Acoma share basic architecture and art designs with other pueblo groups. Language, dress style, music, dances, and food preparation are also similar among the Keresan-speaking pueblos. Spanish influences were never as pronounced at Acoma as among the eastern pueblos because of its more remote location and distinctive history (Garcia-Mason 1979, 452).

The Acoma stress clanship. Families claim descent, proscribe marriages and preferred residency through matrilineal clans, which also may, upon occasion, control ceremonial knowledge. The Acoma are governed by the highly respected chief priest or cacique who "directly regulates the religious life of the Pueblo and indirectly controls secular governance through his appointment of the Council" (Holmes 1989, 12). The Acoma have their own system of government, and the entire reservation is within tribal jurisdiction. Jobs are often sought in towns outside the reservation, and modern American culture continues to influence the traditional culture.

## Zuni Pueblo

Zuni peoples claim ancestral ties to the Zuni-Cibola region.<sup>36</sup> Although these ties do not include much

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36. The Zuni-Cibola region extended from the upper watersheds of the Puerco River of the West and the Pueblo Colorado Wash to the San Francisco Peaks, southward to the Mogollon Rim and the upper Gila River, eastward to the Magdalena Mountains, and thence along the southern and western edge of the Grants lava flow (Holmes 1989, 7-8).

of the lava flows of El Malpais, the Zuni recognize and use some sacred places that are within the national monument. Archeologists have documented continued cultural development in the Zuni area from Basketmaker times forward, from early isolated pit houses to the large pueblo villages of the late prehistoric period. For example, the historic village of Hawikuh, 15 miles southwest of Zuni Pueblo, was "occupied from about A.D. 1300 to 1680 by the ancestors of the modern Zunis" and the Zuni valley has been "occupied continuously from an early period. ." (Woodbury 1979, 467).

Details of Zuni architecture and ceramics show influences from the Chaco Canyon cultural center to the northeast and from the Upper Gila regions to the south. These southerly influences may have had something to do with the language differences between the Zuni and their Keresean-speaking pueblo neighbors.

During the mid 1500s, Zuni contact with Europeans "began in violence" as the Zuni villages resisted the efforts of the Spanish to convert them and extract tribute or material goods to support Spanish missions and communities (Woodbury 1979, 469). Over the next 150 years, the Spanish built missions in the Zuni-Cibola area, and intermittent periods of friendly relations between these two groups were interspersed by hostilities. The missions were alternately abandoned and reoccupied, and Hawikuh mission was destroyed during the Pueblo Revolt of 1680. Following the uprising, the Zuni fled to refugee sites on defensible mesa tops, including Dowa Yalanne, known today as Corn Mountain. During the next decade, there were significant decreases in the refugee populations.

In 1692 the refugees gathered together and returned to Zuni Pueblo, leaving their other five towns vacant. Some of the complexities of social and ritual organization found in modern Zuni society may be due to this integration of previously independent towns as well as to the outside influences mentioned earlier (Woodbury 1979, 472). In 1820 the Spanish ended their mission efforts at Zuni, partly in response to continued Zuni resistance and partly because of increasing raiding by Apaches and Navajos.

An early, short-lived attempt by the Spanish to settle in the Zuni area had failed, and it was not until the 1860s that Spanish-speaking communities were established east of Zuni. During the mid

1800s, the Zuni established a more dispersed settlement pattern with summer farming villages in outlying areas with prime farmlands; eventually these became permanent year-round settlements. The coming of the railroad in the 1890s to Gallup, 40 miles north of Zuni, opened the region to a variety of outside influences.

Over the next 75 years, various churches worked to establish missions at Zuni, and the Bureau of Indian Affairs became increasingly involved in tribal affairs. During the 1900s, the Zuni Tribal Council "gradually increased in size and importance and came to achieve a dominant position in the political life of Zuni" (Woodbury 1979, 478).

Zuni, now the largest of the pueblos in the El Malpais region, has developed a strong educational system and built a crafts industry around the production of jewelry. Recent establishment of the Zuni-Cibola National Historical Park within the Zuni reservation paves the way for additional tourism in this area.

Despite these many outside influences, Zuni has managed to maintain its complex traditional world view in which social, religious, and political customs are strongly interconnected to the age-old ceremonial and religious cycles. The maternal household remains the "social and religious center of the family" (Ladd 1979, 482).

The Zuni-Acoma Trail (alternately the Acoma-Zuni trail) marks a centuries-old travel corridor between these two areas.

## Laguna Pueblo

Laguna peoples now reside in six major villages beyond Old Laguna, a large pueblo situated on a knoll overlooking the Rio San Jose. Some historians have speculated that Laguna Pueblo was founded in the last few years of the 17th century by refugees from several other Keresean-speaking pueblos, and that Acoma people were among the original settlers at Laguna. Other researchers point to traditional interpretations of both Acoma and Laguna origins and to archeological findings, noting that the peoples who call themselves Laguna were in this area before the arrival of the Spanish. In either case, "it is impossible to discuss the prehistory and legendary history of Laguna without considering that of Acoma" (Ellis 1979, 439).

Before A.D. 1400, the Acoma-Laguna area stretched from the Rio Puerco on the east to the Zuni Mountains on the west, and north to south from Mount Taylor to Alamocita Creek and the Rio Salado. A cultural continuum of human occupation in this area can be traced for hundreds of years; culturally this area was peripheral to developments in the nearby Anasazi areas and in the Mogollon region to the south. Mesa Verde peoples may have had an important place in the prehistory of both the Acoma and the Laguna, especially in the 14th century occupation of the village of Punyama on the Rio San Jose.

Some survivors of the 1680 Pueblo Revolt moved first to Acoma, then later to Laguna lands where they settled. By this time the Laguna had begun to establish summer farming areas, and eventually these farms became year-round pueblitos (Ellis 1979, 441). During the 1700s and early 1800s, small Laguna family farms and ranches gradually grew outward gradually from Old Laguna until raids by Apachean groups put a stop to the expansion.

Spanish settlers preempted some of the southern Laguna herding lands after the mid 1700s and, as elsewhere, introduced the Catholic religion and Spanish culture. In the 1800s the Laguna farming areas, which used both dry farming and ditch irrigation, were again expanded, and permanent villages were established. Laguna social organization was much like that of Acoma, with matrilineal clans assuming importance in marriage and other secular functions. Religious activities were primarily the responsibility of the religious societies. Tribal leaders known as caciques governed the pueblo.

By the late 1800s, a number of Protestant missionaries had come to the pueblo. Several married into the Laguna community, adding a new element to the combined native and Roman Catholic religious influences. Acculturation pressures led to a major break in Laguna society, and the more conservative members of the pueblo moved away, disrupting the religious hierarchy of Laguna. This small group of traditionalists went to Isleta Pueblo, some of their members eventually returning to Mesita (a former farming village). This

break led to adoption of a constitution by which Laguna is still governed (Holmes 1989, 15).

While still retaining a rich ceremonial and cultural identity, the Laguna today appear to be one of the most acculturated of the pueblos.

## The Navajo

There is no real consensus as to the exact date the Apachean peoples now known as the Navajo reached this part of the Southwest, but their southward migration must have brought them into contact with puebloan groups not too long after A.D. 1300 (Brugge 1983,490). These migrants brought with them an economic dependence on hunting and gathering.

By the time the Spanish arrived in the Southwest, Apachean peoples occupied the lands surrounding the western pueblos. Extremely adaptable people, the Apaches de Navajo (the Navajo) acquired elements from the sedentary pueblo cultures – like agriculture, ceramics, and a more formalized political structure.

In the early 1600s, the Spaniard Benavides described Navajos as semi-sedentary peoples who planted corn and hunted for game, lived in “underground” homes in rancherias, and were efficient traders (Brugge 1983, 491). Benavides reported an encounter with the Navajo near the base of Mount Taylor, placing them in the vicinity of El Malpais early in the 1600s.

The Navajo “participated in the Pueblo Revolt of 1680 and shared in the captives taken” (Brugge 1983,491). However, as the Spanish reconquered the rebellious pueblos, puebloan survivors fled, some to camp among the Navajo. Eventually these puebloan refugees began to build more permanent homes among their Navajo hosts. By the 1730s, “the pueblito tradition flourished alongside that of the hogan . [and] the Dineta became the center of a cultural development that has no equal in Apachean history”<sup>37</sup> (Brugge 1983, 493). The Navajo had acquired horses and metal objects from the Spanish, and the Puebloan refugees introduced

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37. The Dineta is the upper portion of the San Juan River drainage where Puebloan refugees lived with their Navajo allies.

European items like cattle, sheep and wool, and peaches.

Drought and attacks by the Ute contributed to conflicts between the Navajo and the Puebloan peoples, leading to Navajo rejection of some elements of Spanish and Puebloan culture. Cattle and sheep herding were another matter. Herding gave the Navajo an advantage during warfare. These highly mobile resources -their herds – could be shifted quickly from place to place.

For the next century, warfare continued among the Navajo, Spanish, and Puebloan groups. Some historians have described the Navajo as hostile raiders against whom the Calvary had to protect the peaceful Spanish and pueblo inhabitants. Others understand that the Spanish may have precipitated much of the unrest and that the Navajo “were more sinned against than sinning” (Roessel 1983, 506). This period of warfare ended in 1864 with the defeat of the Navajo and their long forced march to Fort Sumpter, a 300-mile journey of “hardship and terror” (Roessel 1983, 513).

Four years later the Navajo returned to a greatly reduced homeland, now the Navajo Reservation. Seven of the returning families reestablished the Ramah band in the Ramah Valley. The Ramah Reservation was established by the tribe and federal government in 1931 from individual Navajo allotments and federal purchases and exchanges (Roessel 1983,520).

The fundamental social and economic unit of Navajo organization is the residence group, organized “around a head mother, a sheep herd, a customary land-use area, and sometimes agricultural fields” (Witherspoon 1983, 525). Cooperating family groups form an outfit that shares access to major resources.

The Navajo universe is orderly and composed of interrelated elements, each having its own place. When illness or trouble comes, it is important to the Navajo to know the traditional ways of performing ceremonies to restore harmony to this universe.

Today the Ramah Navajo constitute a chapter of the larger Navajo Nation. The Ramah Tribal Council

provides secular leadership for the community, and serves as official representative to the “Big Navajo” and to outsiders.

The only historic archeological sites in El Malpais that can be definitively traced to contemporary peoples are Euro-American and Navajo. Most of these consist of either homesites or stone corrals associated with sheep herding.

## Summary

El Malpais has been used by the Acoma, Zuni, Laguna, and Navajo tribes in a variety of ways for centuries.<sup>38</sup> Acoma peoples have strong ties to the land base that is now the national monument. El Malpais was a traditional winter sheep and cattle herding location in the second half of the 19th century. Once, Acoma had land tenure here, so there is more than the tie through traditional uses. Wild sheep were captured in the cones and lava flows. The Acoma farmed near San Rafael and in Cebolla and Cebollita Canyons. The Acoma-Zuni Trail has long been an important transportation, trade, and pilgrimage route. Acoma gather herbs and other plants and natural resources and maintain shrines in El Malpais. The area of the lava flows, including springs, hills, meadows, and lava features, figures prominently in Acoma legends, stories, and religious beliefs. Some geographic features were used to define Acoma boundaries. Because of its proximity to Acoma Pueblo and a continuum of traditional use the eastern portion of El Malpais along NM 117 is probably used most by the contemporary Acoma.

The Zuni grazed sheep and hunted deer through the Zuni Mountains. Several trails across the lava (including the Zuni-Acoma Trail) were important trade and pilgrimage routes. Bandera Crater and the Ice Cave are important in Zuni cultural traditions, and the Zuni collect pinon nuts and other natural resources in this area.

The Laguna herded sheep throughout the Zuni Mountains and the holes-in-the-wall of the lava flows. Although we know little of their contemporary gathering activities, it is assumed that they also gather medicinal plants and other resources.

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38. This summary is abstracted from Holmes 1989, 21 et seq.

Ramah Navajo gathering and other traditional activities, particularly the collection of pinon nuts, are more focused on the western portion of El Malpais, especially in the national conservation area.

The major ongoing land use of El Malpais by all four groups is religious.<sup>39</sup> While this use is, for the most part associated with shrines that are visited on a regular but occasional basis, there are probably additional but unidentified activities such as religious pilgrimages, locations for a variety of religious offerings, and collection of medicines and materials for religious offerings.

## HISTORIC RESOURCES

Although El Malpais is well known in the oral history of local American Indians, its written history begins in the mid 1500s with the journals of the Spanish conquistadors.<sup>40</sup> These explorers skirted the lava flows or “bad lands” in their far-flung search among New Mexico’s pueblos for mineral wealth and converts to Christianity. Over the next four centuries various explorers, settlers, and missionaries – including the Spanish, the Mexicans, and the Americans – came to this region.

After the first wave of Spanish explorers and soldiers came the priests who established missions at the pueblos. Later settlers were drawn by the generous land grants, or ranchos, a settlement pattern that was to characterize New Mexico for over two centuries.

In mid 1776, Franciscan friars Dominguez and Escalante started westward from Santa Fe hoping to find a good overland route to link New Mexico with the Spanish empire in California. Failing at this, they returned to Santa Fe on a route through the

Grants/El Malpais area. This expedition is memorialized as the present-day Dominguez-Escalante Trail.

Following the Louisiana Purchase, the United States became embroiled with the Spanish over boundaries. Eventually Mexican citizens declared independence from Spain, and New Mexico became part of the Republic of Mexico. It was only a short time before the Santa Fe Trail and all its new trading opportunities opened a major transportation corridor between the United States and the Mexican Territory.

However, Mexican control over the area was short-lived, ending with defeat in the Mexican-American War of 1846. With the treaty of Guadalupe Hidalgo, New Mexico became part of the United States, abruptly terminating “more than 300 years of Spanish-speaking control of New Mexico” (NPS, Mangum 1988c, 22).

It was only a short time before American military expeditions began to explore the Southwest. Scientists, surveyors, and explorers like Simpson, Sitgreaves, Whipple, and Beale traversed the grassy valley between the slopes of Mount Taylor and the northern sections of El Malpais. Following old Spanish and Indian roads, they pioneered the 35th parallel route for future highways and railroads westward to California. This transportation corridor skirted the lava flows and mountains and followed the all-important springs and other water sources.

Today only traces remain of these early roads. One cuts through the central portion of section 7 south of the proposed multiagency center site. Others are obliterated by the Santa Fe Railroad, I-40, and old US Highway 66.<sup>41</sup> I-40 is the most recent adaptation of the old travel routes.

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39. Some geological features and geographic areas are important to native Americans. These landscape features may be shrines or special spiritual places – places described in creation stories or illustrating events in mythological times. Some places also hold an element of danger – like burials, major ceremonial sites, and Navajo sweat houses. Other places are important because of special natural materials, plants, animals, dyes, herbs, etc. Pilgrimage trails and ancestral village sites are sensitive to native Americans as well.

40. The following discussion is abstracted from Mangum’s 1988 history of occupation in the El Malpais area (NPS 1988c).

41. This corridor is also described as the Northern Arizona Transportation Corridor, map 3.1, in the **Comprehensive Plan for New Mexico’s Statewide Architectural Survey, A Five-Year Plan** (Hicks et al. 1985, 84).

American settlement did not immediately follow the early expeditions and roads. Navajo and Apache raiding prompted nearly 25 years of American military activity in the Southwest. Forts were garrisoned and cavalrymen were sent out to chastise the raiders. One of these forts was Fort Wingate, built in 1862 in the "lava-filled Ojo del Gallo valley where two major thoroughfares -the old military road to Fort Defiance and the old Spanish highway to Zuni – intersected" (NPS, Mangum 1988c, 35).

After the long tragic walk to Bosque Redondo, the Navajo returned to reservations, and Fort Wingate was closed. Establishment of reservations effectively opened this part of New Mexico to settlement despite prior claims to the land by various American Indian groups.

In 1869 the village of San Rafael arose close to the site of old Fort Wingate. Many of San Rafael's first residents were ex-military people and Spanish-Americans who began developing the area into an agricultural and sheep ranching community. As San Rafael prospered, other homesteads and communities were built, including Ramah which was settled by Mormon pioneers in the late 1870s.

In 1873 the valley north of El Malpais was surveyed for the railroad. As the rails moved west, small communities such as Grants grew up to serve as supply stations. Grants did not die out as did many of the other villages; instead a post office and a trading post were established. Eventually Grants became an important shipping point. By the late 1880s, vast acreages of land in the vicinity, purchased from the railroad land grants, had become large sheep ranches. These large ranches in and adjacent to El Malpais included the Telles, Chavez, Barela, and Mirabel holdings. The Mirabels owned or leased over 250,000 acres of land in the vicinity of **Bandera Crater**.

These large landowners leased out herds under a system of "partidos" -where the lessee supervised the herds and returned to the landowner "his original herd plus a percentage, with the lessee retaining possession of the remainder" (NPS, Mangum 1988c, 53). Numerous Basque herders took advantage of the **partido** system, and "at the height of the sheep industry, 1880 to 1925, scores of sheep camps dotted. . . the malpais" (NPS, Mangum 1988c, 53). Historic photographs show

herders, tents, and flocks of sheep in the vicinity of **Bandera Crater**.

During the late 1880s, the cattle industry began to inroads into the region (NPS, Mangum 1988c, 53). The Arizona Cattle Company purchased a huge acreage south and west of the badlands from the Atlantic and Pacific Railroad. The Cebolla Cattle Company and the Acoma Land and Cattle Company acquired land east of the badlands and west of Grants at Bluewater, and the Zuni Mountain Cattle Company bought lands and began operations in 1892. The cattle and sheep industries continued to expand until the severe droughts of the 1890s and the Panic of 1893 forced cutbacks. However, large operations still have holdings in and around El Malpais.

Timber was first harvested from the Zuni Mountains to build Fort Wingate; when the railroad came through this area, hundreds of ties were supplied from the Zuni Mountains. In 1890 the short-lived Mitchell Brothers Lumber Company, in cooperation with the Atlantic and Pacific Railroad, built a spur railroad (the Zuni Mountain Railway) into the Zuni Mountains to move the timber out to the main line. American Lumber acquired the defunct Mitchell Brothers operation in 1903 and for a time shipped an average of 100 carloads of logs per day eastward to their sawmill and planing plants in Albuquerque.

The logging industry in the Zuni Mountains operated until the Great Depression. In the early 1930s, Grants businessmen leased and operated one of the big timber operations in the Zuni, working the area around **Paxton Springs** (a few miles northwest of **Bandera Crater**). As major timber areas were exhausted, operators moved south and west into previously uncut areas, including the **Bandera Crater** area. Revived briefly after World War II, the timber industry eventually reverted to small individual operators with portable sawmills who continued to operate in the area.

The proposed **Bandera** visitor center is to be built near the badly deteriorated remains of several cabins once associated with a 20th century lumbering operation, probably the **Breece** Lumber Company. These hastily erected cabins, known as Bill Morgan's Camp, had dirt floors and were intended for temporary shelter only. Apparently they were used about six months before abandonment

(Neil Mangum, personal communication, April 5, 1989).

The cut timbers and piles of sawdust closer to NM 53 in the **Bandera** area were a small sawmill that postdated World War II. The mill lasted for about six or seven years, producing boxcar liners and railroad ties from logs purchased from David Candelaria (Neil Mangum, personal communication, April 5, 1989).

The 1916 Homestead Act, the railroad, and the thriving timber industry at Grants all worked together to increase the number of homesteads on the periphery of the badlands. Completion of the Bluewater Dam and Irrigation Reservoir in the late 1920s opened additional arid lands to settlement.

During the Great Depression, “the eastside of the malpais became dotted with new arrivals” who erected simple dugouts, or timbered or poled houses, built on stone foundations uprooted from nearby prehistoric sites (NPS, Mangum 1988c, 60). However, the dryland farming was seldom profitable, and many of the settlers moved on before the three-year homestead period was up. Many of these homesteads are still visible today, some in the vicinity of the Sandstone Bluffs.

During the 1920s and 1930s, the sheep and cattle business was plagued by low prices, overgrazing, and disease, forcing many small ranchers out of business. With the declines in the cattle, sheep, and lumbering industries, agriculture and mining began to assume more importance in the region. Produce farms grew up west of Grants. New mining activity included fluor spar mines along the west side of the badlands as well as pumice extraction operations north of Grants.

During World War II, 9 square miles of the badlands (centered on **McCartys** Crater) were reserved as a bombing practice range for planes from Kirtland Air Force Base in Albuquerque. Following the war, this area was restored to the public and private sector, and efforts were made to remove all unexploded ordnance.

The local landmark of Kowina along NM 117 is another reminder of the area’s past. Development in this area, spearheaded by ranchers Mark and Ina Elkins and Artie Bibo, honored “the western pioneers, and the rich, proud heritage of the Acoma Indians” (NPS, Mangum 1988c, 72). The facility and

surrounding land, on a mesa just east of NM 117, were sold in about 1980 to the Acoma Indians.

The discovery of uranium propelled Grants into a period of growth, which peaked between 1960 and 1980. Since then, the lessened demand for uranium has been reflected in the Grant’s economic downturn.

Since the 1930s, the tourist industry has steadily grown in the Grants area. Construction of major transcontinental highways across northern New Mexico, first US 66 (hard-surfaced during the 1930s) and later I-40, helped popularized major tourist attractions like **Chaco** Canyon, Petrified Forest, and Grand Canyon. As early as the 1920s, the custodian at El Morro urged the preservation of the Ice Cave at **Bandera**.

Early efforts to include the Ice Cave and **Bandera** Crater in the national park system failed, so local rancher and businessman Sylvestre Mirabel acquired the Ice Cave and leased it to homesteader Cecil Moore. By October 1938 Moore had upgraded the narrow, rough path to the Ice Cave and replaced the crude tree-trunk ladders with a wooden stairway.

Envisioning a dude ranch, Moore built a “series of rustic cabins, restaurant, service station, and bar to cater to the motoring public” (NPS, Mangum 1988c, 71). Moore operated the business for less than four years; eventually the ownership passed to Mirabel’s daughter, Prudenciana Candelaria. During World War II the Ice Cave was sporadically opened for tourists. In addition, the development was used briefly as a cowboy camp. Candelaria’s son David and his wife Cora have managed the cave since 1946. Electricity was installed in 1955, and NM 53 was paved in 1966, making it easier for tourists to reach the cave and adjacent crater.

Today the Candelaria trading post complex includes approximately 13 log structures built at the base of **Bandera** Crater among scattered islands of rough black lava in an open forest of ponderosa pine. The metal-roofed log cabins and larger log trading post are grouped around an irregularly shaped parking area paved with crushed black cinder. Wood-rail fencing separates the parking area and the cabins. There is a small picnic area southeast of the parking area. A crushed cinder path leads from the trading post to covered wooden platforms and steps down into a large cavern -the

commercial Ice Cave – whose inner cavity is filled year-round with ice. Another wide cinder trail winds gently across the southern slope of Bandera Crater and circles into its deep interior crater.

Four of the log cabins and trading post building were in place by 1939; the other cabins were constructed later. Across the entrance road east of the trading post is a newer cabin that was moved in within the last two decades. Northwest of the trading post are two rustic frame outhouses.

The cabins and trading post are constructed of peeled round logs with square lock-notched corners. Horizontal joints are chinked with a combination of mud plaster and more recent cement plaster daubing. Vertical board siding cloaks the upper gable ends of the walls. The cabin closest to the trading post on the southeast has a small, open, covered porch.

Corrugated metal, probably original material, covers the single gable cabin roofs and the intersecting "T" gables of the trading post. Both the cabins and the trading post have wood windows and doors.<sup>42</sup> The simple interiors have exposed wood logs; cabinetry in the trading post probably dates from its change in use from a restaurant to trading post.

The campground, since removed, was part of the original tourist/dude ranch facilities. Changes in management and in the nature of local tourism led to deletion of the service station, restaurant, and bar. Changes in tourism also led to the demise of the overnight tourist business at Bandera.

Unused for the last two decades, the older cabins have not been appreciably altered since their construction in 1939. The trading post and a 1946 cabin have been remodeled, but remain architecturally compatible with the rest of the complex.

The Ice Cave/Bandera Crater area is also important as a natural resource and has a long continuum of religious significance to American Indian groups. This complex is historically significant, possessing integrity of design, setting, and material.

Recorded historic archeological sites include transportation corridors, homesteads, and remnants of ranching operations (corrals, hogans, dugouts, cabins, wells, ovens, walls, and other structural remains and debris). Two sites are attributed to the Navajo; 11 others, probably Euro-American sites, date from around 1912 to the more recent past. These sites are found in the eastern part of the monument, in woodland and scrubland zones. When surveyed, four of the sites (including the Navajo sites) were intact: six had been vandalized, and three were eroded. Most sites are over 5,000 square meters in size. Consultations with the New Mexico State Historic Preservation Office indicate that the trading post complex at Bandera Crater is probably eligible for the National Register for its local significance in early New Mexico recreation and tourism, and for the traditional cultural importance of the Ice Cave and Bandera Crater to American Indians, especially the Zuni. Nomination forms are being prepared for this complex. No other properties within the monument are listed on the register or are presently being considered for listing.

## PREVIOUS CULTURAL RESOURCE WORK AT EL MALPAIS

The earliest studies of El Malpais resulted from military and civilian expeditions during the middle to late 1800s. The most important of these was Adolph Bandelier's reconnaissance survey through New Mexico from Arizona to the Rio Grande between 1880 and 1885. Bandelier may have used the Acoma-Zuni Trail to traverse the badlands on his westward journey. He inspected the Cebollita Mesa area and described the "ruins at Ventanas. . . [set] on a high ridge. . . [with] an immense dark malpais on the west" (Marshall et al. 1979, 187 and 192).

Most of the late 19th century and early 20th century archeological research occurred west of El Malpais near Zuni and El Morro, and it was not until the 1940s and 1950s that Dittert and Ruppe began their work around the west flanks of Cebollita Mesa, excavating and recording a number of sites. Dittert's doctoral dissertation described a number of

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42. The cabins have six-light wood casement windows placed horizontally in a series of two or three. The trading post windows are wood, two-over-one light double-hung or horizontal six-light barn sash; a large single-light picture window has been added on the front.

sites in the western portion of the Acoma Culture Province, including Calabash ruins (known today as Kowina ruins). A major site farther south, in the national conservation area, was named for Dr. Dittert and is on the National Register of Historic Places.

Later surveys by the School of American Research in the 1970s covered about 7 square miles in the vicinity of Las Ventanas, a Chacoan outlier site that is also on the national register. More recently other surveys have been conducted on Cebollita Mesa in the adjacent conservation area by the Bureau of Indian Affairs and along the NM 117 by the Laboratory of Anthropology, Museum of New Mexico. A few isolated site-specific surveys were done by the Bureau of Land Management or their contractors.<sup>43</sup> More recent work is underway.

Unfortunately much of the early work was done before the advent of modern dating technologies and excavation techniques. Too often formal reports on excavations were never completed, and it has sometimes proved impossible to substantiate recorded site locations and definitions. Most of the recent surveys were done for compliance purposes – to clear specific, limited areas for development or new land uses. Given these constraints, the relationships among the various documented sites are difficult to assess.

Over the past century, hundreds of books and articles have been written on the Zuni, Navajo, Laguna, and Acoma peoples. The least amount of ethnographic information is on the Acoma and Ramah Navajo, the two groups whose lands are closest to the boundaries of El Malpais; many of the publications are out of date and do not account for the contemporary cultural condition. Documentation of past Indian land claims contains a great deal of information, but for the most part these data are difficult to research or are unavailable to researchers. An overview of these disparate sources is being completed by ethnohistorian Barbara Holmes. In her overview, short summaries drawn from existing literature describe general American Indian uses of El Malpais and tell some of the stories related to the lava flows.

Early historical accounts of encounters between American Indians and Euro-Americans are usually written from the latter's perspective and do not always provide an accurate understanding. Overall, the numerous history studies dealing with New Mexico devote relatively little space to the Grants area. The badlands were skirted by major transportation routes and most early Euro-American travelers. The area is sparsely settled, and only in recent times has it gained more recognition.

In past studies by federal agencies, short discussions of the history of this region have focused on special features like the ice caves or upon activities like lumbering or mining. These sources, as well as public records, newspapers, maps, and personal interviews and other oral histories, have all been synthesized into an overview of the human occupation of El Malpais country by historian Neil Mangum (NPS, Mangum 1988c). Mangum's synthesis deals primarily with the history of the El Malpais region from the earliest Spanish explorations, and with some exceptions does not identify specific historic sites.

A brief cultural prehistory of El Malpais was completed in 1988 (NPS, Ireland 1988a). This document discusses some of the previous research in the area and summarizes the sequence from Paleo-Indian times through the final Pueblo periods and contact with the Spanish; it also gives statistical data on distribution of Anasazi and historic archeological sites.

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43. Much of the previous discussion was abstracted from Arthur K. Ireland's overview of the cultural prehistory of El Malpais (NPS 1988a) and from a description of Anasazi communities by Marshall et al. (1979).

## SOCIOECONOMIC ENVIRONMENT AND VISITOR USE

### REGIONAL CHARACTERISTICS

#### Regional Setting – Overview

El Malpais National Monument is in west-central New Mexico, a relatively mountainous area east of the Continental Divide. The monument is just south of the city of Grants (elevation 6,520 feet) in Cibola County. Cibola County, which extends from Bernalillo County west to the Arizona border, is the newest of New Mexico's counties (created by the state legislature in July 1981). Three-quarters of the land in the pre-1981 Valencia County is now in Cibola County, and most of the statistical data that is available on Cibola County prior to 1981 has been extrapolated from pre-1981 Valencia County – including much of the available demographic data because Cibola County was created after the 1980 census.

El Malpais is about 75 miles west of the Albuquerque metropolitan area, the most populated region in the state. Other major population centers within two hours drive of the monument include Santa Fe (135 miles east-northeast) and Gallup (60 miles west). The Arizona state line is about 70 miles west of the monument.

With a population of about 4,200, the Pueblo of Acoma adjoins the monument on the east. The Ramah Navajo Reservation, which has a population of about 2,000, is west of the monument. The Laguna and Zuni Indian reservations are each within 40 miles of El Malpais, Laguna being due east and Zuni being due west.

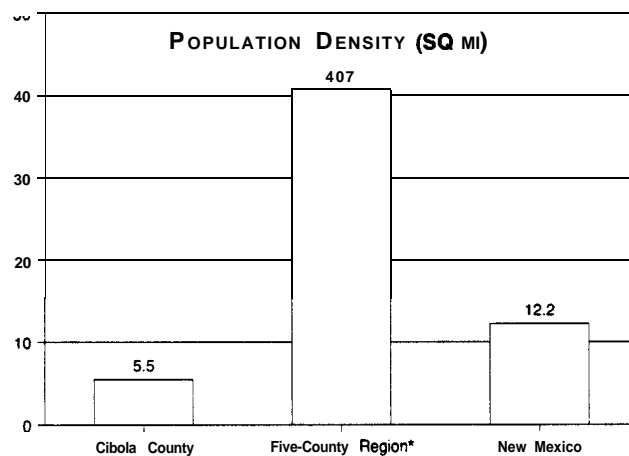
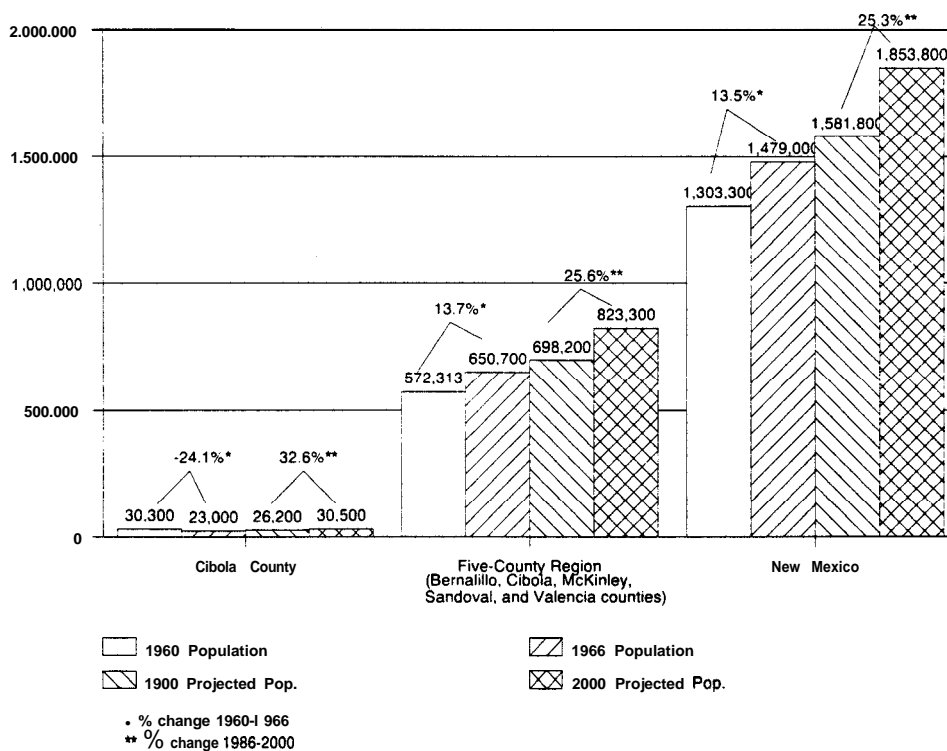
#### Population

The city of Grants and Cibola County have each experienced a significant decline in population over the past decade. The population of Grants has decreased from 11,439 in 1980 to 8,520 in 1986 (a 26 percent loss); Cibola County's population has decreased by 7,300 people in the same period (a 24 percent decrease). Much of this loss is directly attributed to the sharp decline in the demand for uranium ore, which was the mainstay of the local economy during the 1960s and early 1970s.

The region surrounding El Malpais National Monument has experienced a 13.7 percent increase in population since the 1980 census. This region (which includes Bernalillo, Cibola, McKinley, Sandoval, and Valencia counties) accounts for 44 percent of New Mexico's population. Much of the population gain in the region (about 9.4 percent) can be attributed to the city of Albuquerque, the seat of Bernalillo County. The state of New Mexico has experienced a similar gain in residents (13.5 percent) over the same period.

It is believed that Cibola County has reached the end of its period of population loss. The population of the county has stabilized and is expected to increase by nearly one-third by the year 2000, returning the population to a level comparable to before the downturn in the uranium industry. The region and the state are both expected to realize similar gains in population over remainder of the century. Figure 1 summarizes population dynamics for Cibola County, the five-county region, and New Mexico.

**FIGURE 1: POPULATION STATISTICS FOR AREAS SURROUNDING EL MALPAIS NATIONAL MONUMENT**

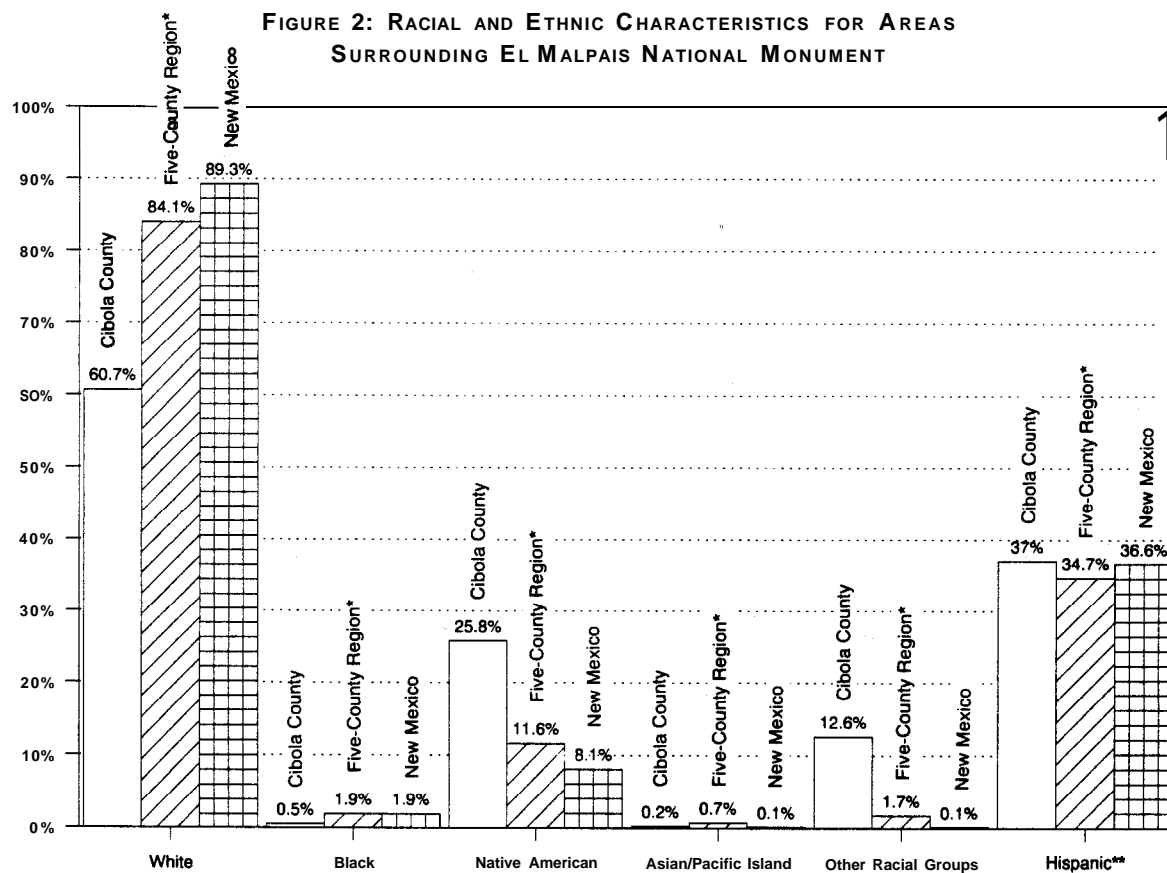


Source: Bureau of Business and Economic Research, University of New Mexico

\*Of the regional growth, 9.4 percent can be attributed to Bernalillo County, which includes the Albuquerque metro area.

Although the racial composition of Cibola County is primarily white, many American Indians also reside in the area. The pueblos of Acoma and Laguna are both within the county. Hispanics are a predominant ethnic group throughout New Mexico, accounting for over one-third of the state's population.

Thirty-seven percent of Cibola County residents consider themselves to be Hispanic. Figure 2 summarizes the racial and ethnic characteristics of Cibola County, the five-county region, and the state.



Source: New Mexico Department of Labor

\*Five-county region includes Bernalillo, Cibola, McKinley, Sandoval, and Valencia counties.

\*\*The Hispanic community crosses several of the above racial groupings.

## Economy

At the southern edge of the uranium belt, the city of Grants was once known as the "uranium capital of the world." However, a severe drop in the uranium market in the late 1970s caused a loss of over 4,000 jobs in the area. The only remaining substantial uranium operation in the region is the Chevron mine near San Mateo (about 15 miles north of Grants), which employs about 400 people.

Since the decline in the uranium market, the city of Grants and Cibola County have made a concerted effort to diversify the area's economy. Local agencies such as the Greater Grants Industrial Development Foundation and the Greater Grants Chamber of Commerce have attempted to bring new business and industry to the area. The efforts of these agencies have been successful, having attracted several small industries to Grants.

The state has also contributed to the revitalization of the area, having recently located the New Mexico Western Correctional Facility (a women's prison) at Grants and a highway department district office near Milan.

Local, state, and federal governments are the principal employers in Cibola County, employing over one-third of the nonagricultural wage and salary work force. The wholesale and retail trade sector accounts for an additional 23 percent of the work force. Unemployment in Cibola County totaled 13.4 percent in June of 1988 (compared to 8.7 percent for New Mexico during the same time period); however, unemployment in the county is down from levels that exceeded 20 percent during the decline of the uranium market. Figure 3 summarizes total nonagricultural employment for Cibola County, the five-county region, and the state.

The average per capita income for Cibola County in 1986 was \$7,253. This figure is lower than the state average (\$11,435) and the five-county region average (\$12,236). Average per capita incomes for other individual counties in the five-county region include: Bernalillo (\$13,472), McKinley (\$6,960), Sandoval (\$11,082), and Valencia (\$10,436).

The retail trade sector contributed the largest share of the total gross receipts for Cibola County in 1987 (over \$83 million). Total gross receipts for Cibola County in 1987 exceeded \$164 million. (This figure does not include gross agricultural receipts, which

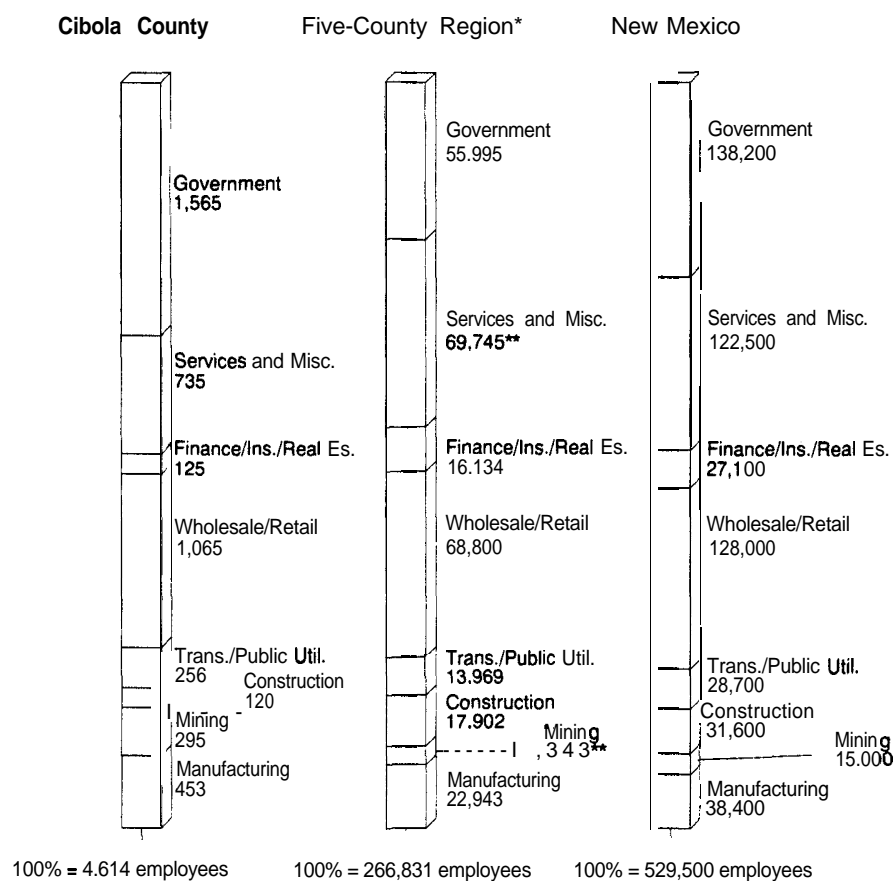
are not yet available for the county for 1987; however, agriculture cash receipts for Cibola County in 1986 were \$8 million, most of which was attributable to livestock production.) Table 8 summarizes total gross receipts for all sectors of Cibola County's economy for 1987.

Tourism is an integral component of Cibola County's economy. In 1986, 437 individuals were employed by lodging or eating/drinking establishments in the county. Gross receipts of hotels, motels, trailer parks, and other lodging places totaled over \$3 million in 1987. Gross receipts for eating and drinking places totaled over \$10 million during the same period. The city of Grants collected almost \$86,000 in lodger tax receipts during its fiscal year 1986-1987.

## Transportation/Access

Grants and El Malpais National Monument are easily accessible by automobile, with one interstate highway and two primary state highways passing through the area. Interstate 40 (I-40), the major east-west thoroughfare from Oklahoma City to Los Angeles, is immediately south of Grants. The proposed multiagency center will be just south of the interstate at the east Grants exit. The current combined adjusted average daily traffic (AADT) for the two exit ramps at this interchange is more than 1,700 vehicles per day. The AADT for I-40 just east of Grants was 12,510 vehicles per day in 1986. Peak monthly traffic volumes occur on this stretch of highway from June through August. During this period, approximately 15,000 vehicles per day pass through the area. February is the month with the lowest adjusted average daily traffic (about 9,500 vehicles per day).

**FIGURE 3: EMPLOYMENT FOR AREAS SURROUNDING EL MALPAIS NATIONAL MONUMENT — 1987  
(NONAGRICULTURAL WAGE AND SALARY EMPLOYEES)**



Source: U.S. Department of Commerce, Bureau of Census, 1980

\*Five-county region includes Cibola, Bernalillo, McKinley, Sandoval, and Valencia counties.

\*\*Valencia County mining employment was included under the services and miscellaneous sector rather than under the mining sector.

**TABLE 8: GROSS RECEIPTS FOR MAJOR ECONOMY SECTORS  
CIBOLA COUNTY – 1987**

Sector	Receipts (\$000s)
Retail Trade	\$ 83,016.2
Transportation, Communications, & Utilities	30,338.6
Construction	18,984.9
Services	14,942.1
Wholesale Trade	9,357.8
Manufacturing	5,846.9
Finance, Insurance, and Real Estate	1,404.9
Mining	<b>860.3</b>
Agricultural*	8,009.0*

\*1986 receipts, most of which were from livestock production. Agricultural receipts for 1987 were not available.

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Sources: New Mexico Taxation and Revenue Department and New Mexico Agricultural Statistics Service

New Mexico Highway 117 (NM 117), sometimes used as a short-cut from Albuquerque to Phoenix, runs roughly parallel to the eastern boundary of the monument. Access to this highway is gained by way of I-40 just east of the Grants city limits. AADT on NM 117 was 206 vehicles per day in 1986 (measured at the interstate). AADT on this road tapered to 84 vehicles per day at the York Ranch (near the southern limit of the monument).

New Mexico Highway 53 (NM 53) skirts the western edge of monument and enters Grants near the western city limit. The highway is used by many as a route to El Morro National Monument (about 20 miles from the western boundary of the El Malpais National Monument). AADT on NM 53 was 3,482 vehicles per day at the Grants city limit in 1986. The traffic decreased to 409 vehicles per day at a point approximately 24 miles south of Grants.

NM 53 and NM 117 are connected by Cibola County Route 42 (Route 42), an unimproved dirt route that passes through the national conservation area south of the monument. The road enters the boundaries of the monument near its intersection with NM 53 just west of Bandera Crater. Route 42 receives limited use, and is periodically impassable because of muddy conditions.

Commercial air transportation to the area is through airports at Albuquerque and Gallup. Several major carriers service the Albuquerque airport, while only commuter service is available to Gallup. AMTRAK also provides passenger rail service to both Albuquerque and Gallup. Greyhound and Trailways provide commercial bus service to Grants.

### **Regional Visitor Services**

A full range of visitor services is available in the greater El Malpais area. Visitors to the area can find lodging, restaurants, gasoline and automobile service, and many other necessities in the town of Grants. A short drive to either Albuquerque and Gallup gives tourists an even greater range and number of services.

Lodging is ample in Grants and the surrounding area. Grants has 15 motels that have a combined total of over 800 rooms. An additional 109 inns and 102,000 rooms are available in Albuquerque and Gallup. For those who prefer camping to indoor lodging, 27 public and private campgrounds are within an 80-mile radius of El Malpais. These campgrounds, which range from primitive to modern, have a combined total of almost 1,500 sites.

The city of Grants supports more than 30 restaurants, as well as numerous gasoline stations and gift shops. Other businesses in town include grocery and convenience stores, clothing shops, sporting goods dealers, and banking institutions.

A broad range of medical services is available in Grants. Medical resources include a 43-bed public hospital, which provides a comprehensive range of services (including ICU/CCU and neonatal care). A number of physicians, dentists, and optometrists practice in the Grants area. Emergency medical transportation is also available.

## REGIONAL RECREATION RESOURCES AND USE

El Malpais National Monument is part of a geographically extensive network of unique southwestern parklands that will soon be connected by a formally designated automobile touring route known as the Masau Trail. Visitors to the I-40 multiagency center will receive a general introduction and orientation to trail facilities. The legislation establishing the monument specifies that the trail will link El Malpais to El Morro National Monument, Chaco Culture National Historical Park, Aztec Ruins National Monument, Canyon de Chelly National Monument, Pecos National Monument, and Gila Cliff Dwellings National Monument. Public Law 100-567 (October 31, 1988) provides for the addition of Zuni-Cibola National Historical Park to the network of facilities connected by the trail. Other sites of national significance may be added to the network from time to time under guidelines in the legislation and in the plan being prepared for the trail. The Masau Trail plan is currently being prepared by the NPS Southwest Regional Office. In addition to providing the overall management framework for the trail, this plan includes a conceptual marketing plan and strategy that will promote public awareness of the trail and its sites on a regional, national, and international level.

The area surrounding El Malpais encompasses many recreation lands and facilities. Most of these lands have as their base the rich natural and cultural resources of west-central New Mexico. A brief description of some of the recreation attractions in the El Malpais area is presented below.

The **New Mexico Museum of Mining** in Grants interprets the history of uranium mining, which was very important in the development of western New Mexico. Visitors are able to descend underground and take a guided tour of a replicated uranium mine.

The **Pueblo of Acoma**, also known as **Sky City**, is 22 miles east of Grants and 13 miles south of I-40. The pueblo is the oldest continually occupied Indian village in the United States, dating back to the mid 1100s. Access to Sky City, which is on a high mesa, is by bus tours from the base of the mesa; guided tours are offered daily.

**Cibola National Forest** provides myriad recreation opportunities for visitors. One of the most popular areas is Mt. Taylor, just northeast of Grants. The peak is about 11,300 feet in elevation and can be seen from several locations within the monument. Hiking, hunting, cross-country skiing, and snowshoeing are a few of the activities available in this area. The U.S. Forest Service also manages five developed automobile campgrounds within the national forest.

**El Morro National Monument** is about 20 miles west of El Malpais National Monument and is accessed by way of NM 53. The monument is best known for Inscription Rock, an impressive sandstone escarpment that contains numerous historic engravings dating as far back as the early 17th century. The monument also includes ruins of ancient pueblos. Limited picnicking and camping occur within the monument.

Twelve miles west of Grants, **Bluewater Lake State Park** provides opportunities for water-based recreation as well as camping and picnicking. Swimming, fishing, boating, and waterskiing are among the most popular activities. The lake is stocked with rainbow trout and catfish, and it is one of the most popular trout-fishing lakes in New Mexico. **Bluewater Creek State Park**, a new addition to the New Mexico state park system, is on the southwest shore of the lake.

Other recreation areas and visitor attractions near El Malpais include the Zuni Pueblo, the Laguna Pueblo, the Ramah Navajo Reservation, Chaco

Culture National Historical Park, Red Rocks State Park, and the Apache National Forest. The Continental Divide Trail, an extensive recreation trail that is currently in the planning stages, will pass through or very close to the monument and the national conservation area.

Private campgrounds and RV parks are numerous in the El Malpais region. Within 80 miles of Grants there are 16 private campgrounds (1,150 campsites). State park, national forest, and NPS campgrounds in the area (80-mile radius) add another 354 sites to this total. Table 9 lists public campgrounds within the area, together with the nearest city or town and the number of campsites available at each facility.

The cities of Albuquerque, Santa Fe, and Gallup also provide a wide range of recreation facilities and opportunities.

Thousands visit the parklands and tourist attractions of the El Malpais area every year. Table 10 summarizes the number of these visits recorded at selected public recreation areas in western New Mexico in 1987. Most of these areas have been steadily growing in visitation in recent years, having

rebounded from declines that paralleled the shortages and high price of motor fuels in the late 1970s.

Although the land now in El Malpais National Monument has supported a variety of recreation uses for a number of years, almost no data exists about the current or historic visitor use. Traditional recreational uses include four-wheel driving, hiking, cave exploration, bird-watching, photography, and nature study. Visitor use projections for the monument and national conservation area are presented in the following section.

A feasibility study is being conducted concerning the development of a tourist railroad that would link Grants to the west side of the monument. This railroad would follow the route of the historic Zuni Mountain Railroad Company from Grants, through the Zuni Canyon, to the area of **Bandera Crater**. The completion date for the feasibility study is April 2, 1990. There is considerable political and community support for this project. A broad range of interests and agencies will be involved in the study and in any subsequent development.

TABLE 9: PUBLIC **CAMP**GROUND S IN THE **EL MALPAIS AREA**  
(WITHIN AN 80-MILE RADIUS)

<u>National Park Service</u>	<u>Nearest Community</u>	<u>Campsites</u>
Chaco Culture National Historical Park	Crownpoint	45
El Morro National Monument	Ramah	9
<u>New Mexico State Parks</u>		
Bluewater Lake	Bluewater	60
Bluewater Creek	Bluewater	6
Red Rocks	Gallup	95
<u>U.S. Forest Service - Cibola National Forest</u>		
Canyon Lobo	Grants	<b>9</b>
Coal Mine	Grants	21
Ojo Redondo	Bluewater	20
Quaking Aspen	McGaffey	20
McGaffey	McGaffey	49
<u>U.S. Forest Service - Apache National Forest</u>		
Quemado Lake	Quemado	20

**TABLE 10: VISITATION AT SELECTED NEW MEXICO RECREATIONAL FACILITIES — 1987**

**New Mexico State Parks**

Bluewater Lake	182,100
Bluewater Creek	10,500
Coronado	201,300
Fenton Lake	159,500
Red Rocks	101,500
Sen. Willie Chavez	71,400

**United States Forest Service**

Canyon Lobo	7,000
Coal Mine	24,700
Ojo Redondo	10,600
Quaking Aspen	23,500
McGaffey	26,000
Quemado Lake	25,000

**National Park Service**

Chaco Culture	
National Historical Park	58,000
El Morro National Monument	56,400

**VISITOR USE PROJECTIONS FOR EL MALPAIS**

Because of the lack of data on existing or past recreation use levels at El Malpais, it is not possible to estimate future visitor use by means of a linear projection of historic statistics. Thus, it was necessary to adopt a different methodology to forecast the level of use that might be expected at the monument.

The methodology selected was comparative capture rates. This approach allowed for the estimation of possible visitation by means of comparison to other areas with similar features and resources and/or similar physical locations. A "capture rate" is the relative percent of motor vehicles that enter a recreation area from an adjacent or nearby roadway. When capture rates are used to predict visitation for a new monument such as El Malpais, careful consideration must be given to the areas selected for comparison. The most accurate forecasts result when the indicator areas are highly similar to the area being predicted.

The parks to be compared to El Malpais National Monument were selected based on two criteria: the primary resource emphasis of the park (i.e., natural, cultural, geological, etc.) and the physical location of the unit (region of the country, relationship to population centers and transportation routes, etc.). Also, because the monument is a unit of the

national park system, only existing NPS facilities were considered for comparison.

Because a principal attraction of the monument is its geological features, this type of resource was considered a primary indicator in the selection of comparison parks. The monument also has a wealth of cultural resources, another important consideration.

A second primary indicator used was the physical location of the areas. Recreation areas selected were proximate to both a large metropolitan area and a major transportation route that supports high average daily traffic.

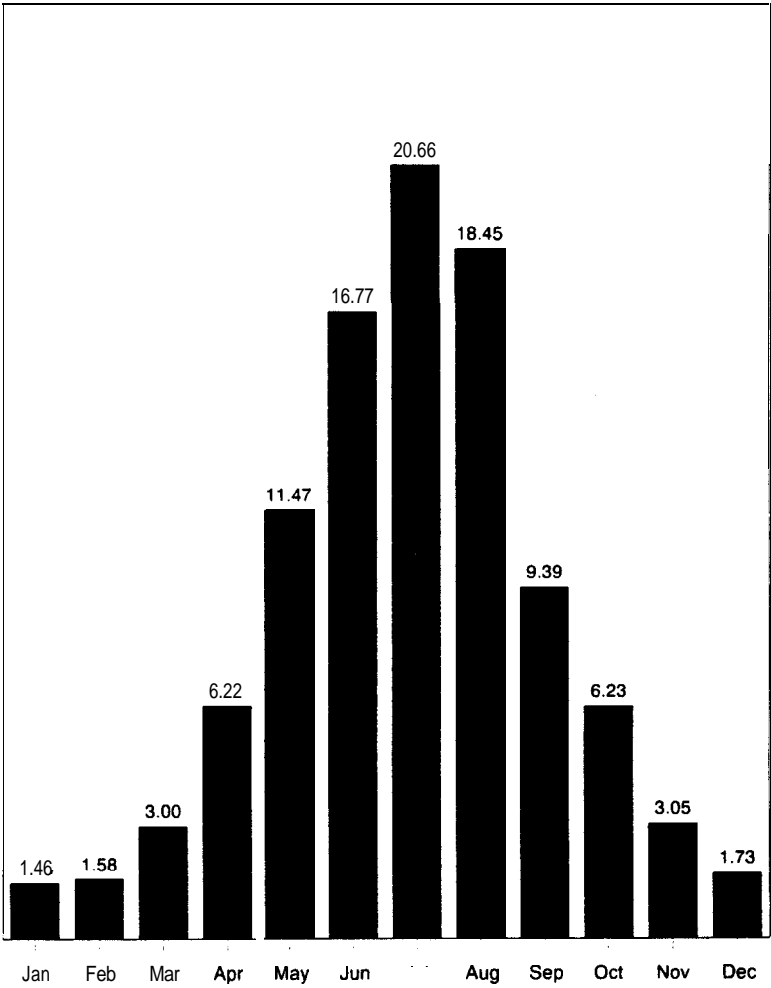
Based on these criteria, nine NPS units were selected for comparison to El Malpais National Monument — eight of which are in the southwestern United States (either New Mexico or Arizona). Most of these units are near a major freeway and/or population center. El Malpais National Monument was most similar to units with capture rates in the range of 1.1 to 2.2 percent. Thus, a capture rate of 1.6 percent was used in projecting visitation for the monument, with 1.1 percent and 2.2 percent being used for low and high range estimates.

Recreation visit forecasts have been developed for El Malpais National Monument by year and by month. The seasonal distribution of recreation visits to the monument is based on a typical extended

summer use pattern. This pattern of use, summarized in figure 4, is characteristic of many NPS facilities in the southwestern United States. Examples of other regional park areas that exhibit this pattern include Aztec Ruins, El Morro, Walnut Canyon, Fort Union, Sunset Crater, Pecos, and Wupatki national monuments. Figure 4 depicts expected monthly use as a percentage of expected annual use. Monthly percentages represent the

average for all NPS facilities exhibiting this use pattern.

**FIGURE 4: SEASONAL VISITATION DISTRIBUTION PROJECTION  
FOR EL MALPAIS NATIONAL MONUMENT  
BY MONTHLY PERCENTAGE OF ANNUAL USE  
(TYPICAL EXTENDED SUMMER USE PATTERN)**

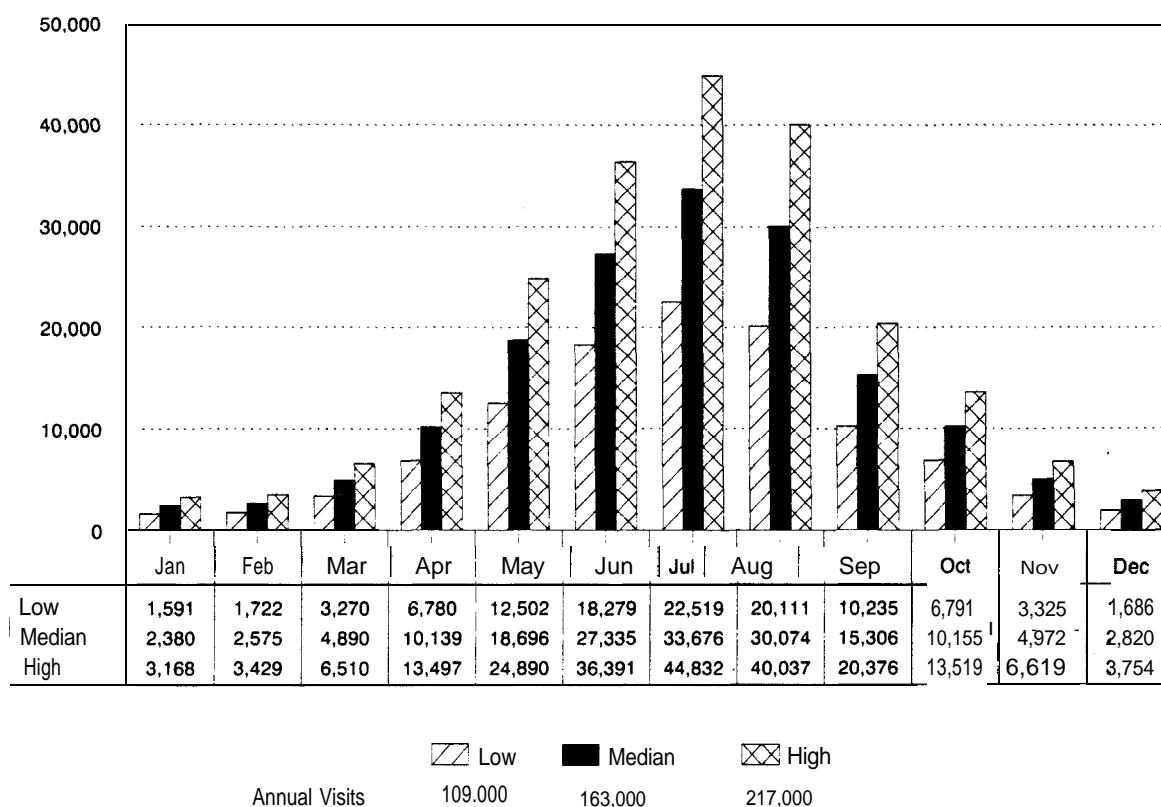


It should be noted that the preceding table reflects gross, overall use patterns. Different types of use may occur from month-to-month or season-to-season that vary somewhat from the above standard. For example, use of the monument by area residents may be concentrated in spring or fall periods, whereas use of the monument by

out-of-area recreationists may be concentrated in the summer months.

Based on the capture rates described above, figure 5 illustrates the possible range of recreational visitation for El Malpais National Monument that could occur by the year 1995.

**FIGURE 5: RECREATION VISITS FORECAST\***  
**EL MALPAIS NATIONAL MONUMENT/**  
**NATIONAL CONSERVATION AREA - 1995**  
**(BY MONTH)**



\*The calculations assume 2.8 people per vehicle, which approximates current trends observed by the NPS Statistics Office. A capture rate of .011 (low), .016 (median), and .022 (high) is used in the figure.

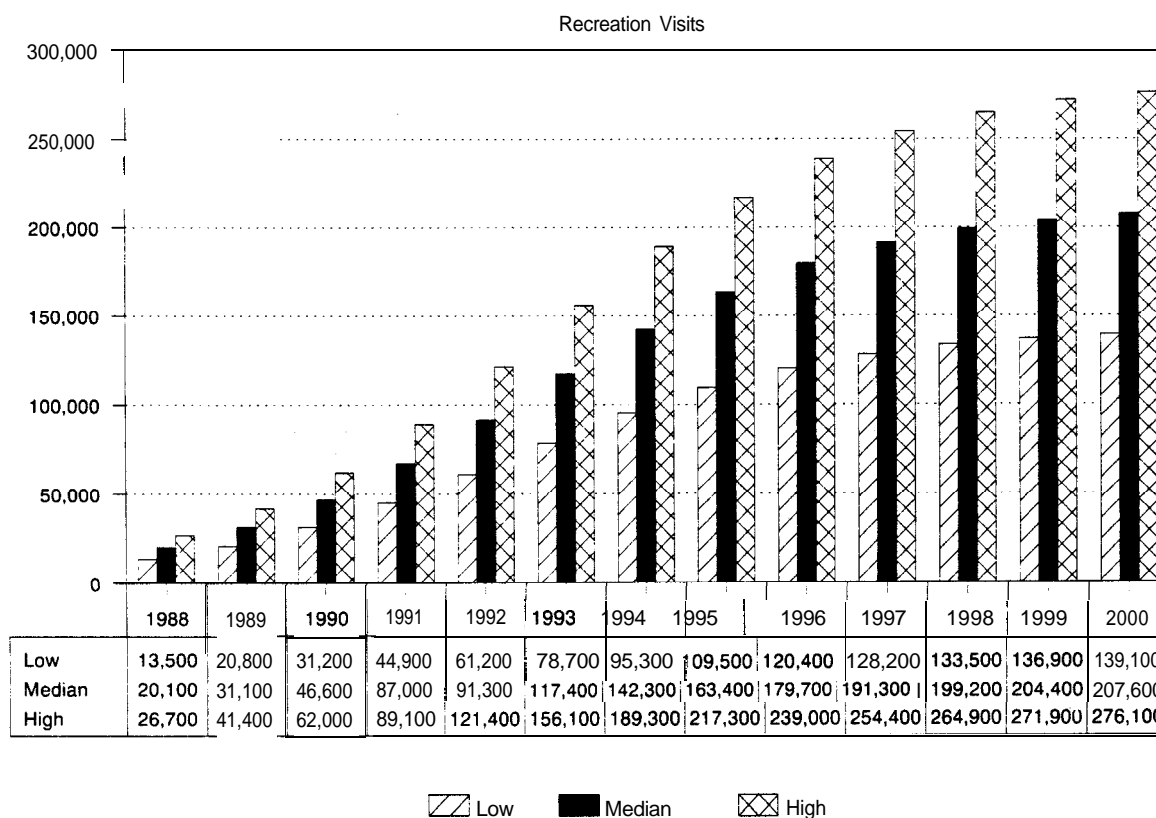
This visitation projection considers El Malpais National Monument and National Conservation Area to be one large recreation area. Although the monument and the conservation area are two distinct entities, it is currently not feasible to make a reliable, systematic prediction of visitation for each of the individual areas. However, it is likely that many recreationists will stop at both national monument and conservation area.

It should be remembered that the projections in figure 5 are based on comparisons to well-established and well-known parks. Thus, the projections inherently assume that El Malpais is also well-established and well-known. This assumption is corrected for in figure 6, which considers the possible growth patterns for the monument. In general, once a park is created, it

typically takes from five to 10 years to reach a level of use comparable to a well-established facility. El Malpais should achieve this visitation around the year 1995. During the period of initial growth (1988-1995), it is assumed that the monument will gain in popularity and that facilities (such as visitor centers, campgrounds, tour roads, and trails) will be developed. Figure 6 also presents low-, median-, and high-case scenarios.

Referring to figure 6, it is possible to determine that annual recreation visits to El Malpais may reach about 207,600 by the year 2000. By extrapolating from figures 4 and 6, it is possible to determine that the average visitation per day during the peak-use month in the year 2000 may be approximately 1,375. The peak-day use in 2000 may exceed 2,000 visitors.

**FIGURE 6: POSSIBLE RECREATION VISITATION GROWTH\***  
**EL MALPAIS NATIONAL MONUMENT/  
NATIONAL CONSERVATION AREA — 1988-2000**



\*Assumes a seven-year initial growth period, with the monument nearing the visitation of a well-established unit around the year 1995. The projections for 1995 correspond to those summarized in figure 5.

It is currently infeasible to forecast use patterns or volumes for specific areas within the monument/conservation area. The volume of use in any one area may vary over time. Use patterns may change significantly as visitor facilities and programs are developed. Use patterns will also vary as El Malpais becomes better known and develops a broader user constituency. Finally, use patterns are likely to change as the ratio of first-time visitors to repeat visitors evolves.

## EXISTING FACILITY ANALYSIS

### VISITOR USE OVERVIEW

Interstate 40, a major cross-country route, parallels the northern boundary of the monument/conservation area. This portion of I-40 actually bisects one of the northernmost lobes of the Grants flow, exposing travelers approaching from the east to a small sample of the El Malpais. There are few signs for the monument. A small interstate sign identifies the Grants exit as the location of the El Malpais information center. Two small El Malpais National Monument/National Conservation Area entrance signs are at the boundary on NM 117 (south entrance) and NM 53 (south entrance).

The temporary El Malpais information center in downtown Grants is currently the only place where visitors can plan their trip to El Malpais and ask questions about other regional attractions. Visitors can obtain an El Malpais brochure and other publications on the resources in the area. NPS and BLM personnel operate this small information center (an information desk and sales/publication area).

From the information center, visitors interested in spending a few hours in El Malpais are directed to the area's major features, including **Bandera** Crater and the Ice Cave and Sandstone Bluffs overlook in the national monument, and La Ventana natural arch in the national conservation area. Most tourists visit what for many years has been a regional tourist attraction – **Bandera** Crater and the Ice Cave, 25 miles southwest of Grants on NM 53. For an admission fee, visitors follow well-defined trails to the crater and Ice Cave. A stairway descends to a viewing platform near the floor of the Ice Cave. Little interpretation is provided at either the Ice Cave or crater. A small trading post adjacent to the trailhead/parking area gives visitors an opportunity to buy Indian jewelry, postcards, and other curios. Many visitors may also choose to travel NM 117 to Sandstone Bluffs overlook for views of the **McCarty's** lava flow. Visitors may also drive farther south on NM 117 to La Ventana – New Mexico's largest natural arch. No interpretation is currently provided at either the overlook or the arch.

Local residents frequently visit Bat Cave (near NM 53, approximately 20 miles southwest of Grants)

during the summer months to see the evening bat flight.

Prior to designation of El Malpais as a national monument/conservation area, the backcountry lava flows were used primarily for pot-hunting (now illegal), four-wheel driving, and hiking. Most of the backcountry still receives little use.

### EXISTING ROADS

New Mexico Highway 53 (NM 53), a paved two-lane road on the monument's northwest boundary, and NM 117, a similar road on the eastern boundary, will probably always remain the primary access roads to the monument and conservation area. I-40, a major cross-country travel route, links NM 53 and 117 in the area of Grants.

Direct access to the monument's main resources is on a small number of secondary roads, the most heavily used being a short graded road from NM 53 to the trading post near **Bandera** Crater. A primitive dirt road winds from the trading post to areas near Lava Crater. This road is on the south slope of Sandstone Ridge above the edge of the **Bandera** lava flow. Another important access road on the west side of the monument is County Route 42, a narrow dirt road that connects NM 53 to NM 117 on the west and south sides of the monument. Table 11 below shows the existing roads and their conditions.

### EXISTING TRAILS

The monument has few existing trails, and those receiving any significant volume of use are in the **Bandera** Crater area (see table 12). These trails total approximately 8.5 miles, are not uniformly signed, and most are surfaced with cinders. None of these trails meet Uniform Federal Accessibility Standards.

TABLE 11: EXISTING ROADS (IN MILES)\*

Name and Location	Dirt	Gravel	Paved	Condition
NM 53 to trading post		0.7		good
Route 42 to East Rendija cutoff	5.3			fair
Cutoff to East Rendija	3.5			poor**
Cerro Encierro	7.3			very poor*
Corral road	3.2			poor*
Bat Cave road	1.5			poor**
El Calderon road	2.9			poor*
Zuni-Acoma trailhead		0.1		good
Sandstone Bluffs road		1.7		good
North pasture ridge road	1.3			fair
North windmill road	.2			fair
North pasture road	5.5			poor**
Mechenbiers lava road	<u>3.5</u>	—		fair**
<b>Total Length</b>	34.2	2.5		

\*With the exception of a portion of Route 42, the table does not contain roads within the monument boundaries that are owned or maintained by county or state government or that are used entirely for private access to nonfederal land within the monument.

"These roads are nonconstructed and extremely rough, requiring high-clearance vehicles. In winter and during periods of heavy rainfall, they are muddy and may be impassable.

TABLE 12: EXISTING TRAILS\*

<u>Name and Location</u>	<u>Approximate Length (miles)</u>	<u>Standard*</u>	<u>Condition</u>
Trading post to Ice Cave	0.2	R	good
Trading post to Bandera Crater	0.8	R	good
Bandera Crater to Ice Cave (motor tour route)	0.5	R	fair
Zuni-Acoma/Acoma-Zuni	7.0	P	fair
Zuni-Acoma trail to overlook – west end (mileage included in above figure)	—	R	good
<b>Total Length</b>	8.5		

\*None of these trails are presently handicap-accessible.

\*\*D - Developed, R - Rustic, SP - Semi-primitive, P - Primitive

(These categories correspond to definitions of the trail standards in appendix D.)

The only other existing trail in the monument is the Zuni-Acoma/Acoma-Zuni trail; this marked route extends 7 miles between NM 53 and NM 117 across the El Malpais badlands. The trail has no treadway but is marked. The western end of the trail is graveled for less than 0.1 mile and leads to an overlook. The last half mile of the eastern end of the trail detours from the historic alignment to avoid Acoma land, and there is no trailhead or parking.

### EXISTING STRUCTURES

Table 13 lists the structures that have potential for continued use in the monument and evaluates their condition. The approximate locations of these structures are shown on the development concept maps.

TABLE 13: EXISTING STRUCTURES

Area	Structure	Function	Condition
Bandera Crater	trading post	information/	fair
	(main structure)*	sales	
	tourist cabins (7)**	storage or empty	fair
	other cabins (3)***	seasonal residence	
		or storage	fair
	pit toilets-	toilets	poor
	parking area*	visitor parking	fair
	rails and fences*	separate visitors	
		from nonuse areas	fair

\*Under consideration for rehabilitation.  
 \*\*Under consideration for stabilization.  
 \*\*\*Under consideration for removal. (Other minor structures such as water tanks and liquid propane tanks are also under consideration for removal; see the Bandera Crater Area development concept map.)

## EXISTING UTILITIES

### Water

The only developed water supply in the monument is for the privately owned trading post at **Bandera Crater**. The source is a surface spring outside the northern monument boundary. The pump and lines leading approximately 2 miles to the trading post often freeze in the winter. The quality and available volume of water in this system has not yet been evaluated. (See the "Water Resources" section for more information.)

### Power/Telephone

Single-phase power (14.4/24.9 volts) is available on an aerial line just north of NM 53 in the monument. The closest three-phase power is 12 miles west of the monument in the **Ramah** area. There is a rural telephone system with aerial lines on the same poles as the powerlines that serve the **Bandera Crater** area. Aerial power/telephone lines also cross the El Calderon area and parallel NM 117 near Sandstone Bluffs.

### Sewage Treatment

Other than pit toilets and septic tanks at the trading post near **Bandera Crater**, there are no sanitary facilities in the monument.

### Radio System

There is no radio communication system for the monument staff; however, a future system is under study and will be installed as soon as possible. Repeater station sites inside and outside of the monument are being considered.

## ADMINISTRATIVE FACILITIES

Since the establishment of the monument, office and storage space for NPS staff has been in rented facilities in Grants, New Mexico. The superintendent initially had office space in the Grants Chamber of Commerce/Mining Museum building. Other monument staff were stationed at a temporary information center at 620 East Santa Fe Avenue. This building was shared with BLM staff,

and space was crowded. In March 1989 NPS staff relocated to the former U.S. Forest Service building at 201 East Roosevelt Avenue. This building is being leased from the U.S. General Services Administration.

## IMPACTS OF PREFERRED ALTERNATIVE (PROPOSED GENERAL MANAGEMENT PLAN)

### INTRODUCTION

This section evaluates the impacts of implementing the preferred alternative, including impacts on the natural and cultural environments, impacts on the visitors, and impacts on the socioeconomic environment.

### IMPACTS ON THE NATURAL ENVIRONMENT

Implementation of the preferred alternative would result in two kinds of impacts on the natural resource and wildlife management. First, the information in the studies and management plans (described in the "Plan for Natural Resources Management" section) would improve the ability of the Park Service to manage and protect the monument's natural resources including backcountry/wilderness, lava tubes and ice caves, air quality, wildlife, threatened and endangered species, and vegetation. Additional inventories and studies would be the basis for prioritizing research and protection needs, and the backcountry/wilderness management plan(s) would establish standards for use in these areas. In short, the information would promote better protection for the monument's natural resources.

Second, impacts would result from visitor use and facility construction; these impacts are described below.

The proposed boundary adjustment would not impact natural resources. The area proposed for exclusion contains no known significant natural resources.

#### General Impacts from Development and Visitor Use on the Natural Environment

Sensitively and properly designed facilities and careful design and alignment of roads and trails would result in minimal resource damage and harmonize with the surrounding environment. Monitoring visitor use associated with development would also aid in more effective management and protection.

Overall, monumentwide impacts from facility development would be minor, with no significant long-term effects on natural resources except minor disturbance of bedrock, which would be an irretrievable long-term loss. Construction and use of facilities associated with the preferred alternative would impact approximately 63 acres or .05 percent of the monument.

#### Impacts on Geological Resources

**Bedrock.** Bedrock within some proposed construction sites would be removed to bury utilities and construct buildings, trails, roads, and parking areas. This would require ripping or blasting. The fracturing/removal of bedrock would be an irretrievable long-term loss of geologic resources.

Exposed sedimentary bedrock in areas of intense visitor use would be subject to defacement (carving of initials) and, in areas of heavy foot traffic, accelerated erosion. The areas with the most potential for bedrock degradation include Sandstone Bluffs and Sandstone Ridge. Sedimentary rock permanently exposed by construction activities would increase the natural erosion rate of this bedrock. Heavy foot traffic in popular visitor use areas such as Sandstone Bluffs would result in minor bedrock erosion; however, trails and viewing platforms would be properly designed to discourage off-trail use.

Site-specific impacts on bedrock follow.

**Multiagency Center** – Construction of a 7,000-square-foot facility with parking and a .2-mile-long approach road would require removal of an unknown volume of basaltic bedrock, perhaps by means of ripping or explosives. Burying utilities between the I-40 exchange area and the facility in two separate trenches for water and sewer mains would entail removal of about 1,900 cubic yards of bedrock, which would be permanently disturbed.

**Bandera Crater/Lava Crater Area** – Construction of a .7-mile two-way road

between NM 53 and the proposed 7,500-square-foot visitor center; a 2.0-mile one-way road between the visitor center and the trading post area; a .3-mile two-way spur road to the Dripping Lava Cave trailhead; a .4-mile two-way spur road between NM 53 and the proposed residential/maintenance area; a .8-mile exit road from the trading post to NM 53; and proposed parking areas at the visitor center, near the trading post, and at the Dripping Lava Cave trailhead entails irreversible disturbance of bedrock. The bedrock that would be disturbed consists of volcanic cinder to unknown depth in an area of 5.7 acres and sandstone/limestone in an area of 3.5 acres – a total surface disturbance of 9.2 acres of bedrock.

The one-way tour road, excavated partly in bedrock, would be on slopes requiring side-hill excavation of sandstone/limestone to a maximum depth of 3 feet (but probably averaging 2 feet), thereby entailing removal of about 2,800 cubic yards of bedrock, which would probably be used as fill elsewhere during construction in order to balance material. The result would be long, 1- to 3-foot-high cuts exposing light-colored bedrock over a distance of 1.6 miles along the lower east, south, and west slopes of Sandstone Ridge. The parking area proposed east of the trading post is likely to be on more than one level and also would be bordered along its upslope side by cuts of similar appearance.

Approximately 3.8 acres – for the proposed visitor center and residential/maintenance areas -would be disturbed by construction, landscaping, and trenches for power, water and sewer lines, and treatment fields. The cinder and other bedrock underlying these areas would be removed temporarily to depths up to 6 feet, and most of it would be used as backfill at the construction sites.

Because new trails proposed in the area require insignificant amounts of bedrock to be removed, little impact on geologic resources is expected. The principal exceptions include the following:

Construction of catwalk-like steps into Dripping Lava Cave, replacing the

stairway into the Ice Cave, and the addition of handicap viewing area would require removal of small quantities of basalt bedrock to level platform areas and drill holes for structural supports.

Construction of a wheelchair-accessible trail of even grade to the Ice Cave would require total removal of about 50 cubic yards of basalt bedrock. Using portions of existing routes would be a significant mitigating factor for reducing disturbance to geologic features.

Marking primitive trails would require frequent cairns; loose boulders in the local surface areas would be used for this purpose.

Fragile “lavacicles,” pencil-slender masses of lava that hang from the walls and ceilings of Dripping Lava Cave (and other caves), could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**East Rendija Area** – The proposed 6-mile 20-foot-wide gravel-surfaced access road to the East Rendija trailhead would disturb about 13 acres and would be built across three types of terrain. The first 2 miles north, west, and southwest of Cerro **Bandera** would be on lava flows with irregular surfaces and shallow soil, probably requiring explosives to make short cuts in outcrops of bedrock. In contrast, the second 2-mile segment, which would likely follow sections of Route 42, would be on relatively flat areas of old lava flows overlain by stony soil; here there would be low potential for disturbing bedrock because adequate drainage would probably be provided by importing material for an elevated road course. Construction of the third and southernmost 2-mile segment on the lower northern slopes of Cerro Rendija would likely require upper- and lower-side balance of stony soil material; removal of bedrock beneath the soil would be possible locally.

Construction of an approximately 1 -mile trail up the southwest side of Cerro **Bandera** would cut slopes composed of cinder and volcanic agglutinate; however, the treadway would be

designed to minimize downslope loss of cinder bedrock and aligned to reduce the potential of visitors shortcutting the switchbacks.

The proposed campground, vault toilets, parking areas at the lava wall and East Rendija, and trails leading to lava caves would be located in areas where little solid bedrock would be disturbed.

Constructed steps into the entrances of Four-Window and Big Skylight caves would be made of boulders from the nearby surface areas; however, supports for hand rails needed in the caves might require drilling holes into boulders or bedrock.

**Braided Cave Area** – Fragile lavacicles hanging from the walls and ceilings of the cave could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**El Calderon Area** – Construction of a .9-mile 18-foot-wide gravel-surfaced road from NM 53 to a new trailhead serving both Double Sinks and Bat Cave would require the same type of road building as the midsection of the East Rendija road (described above). Similarly, eventual improvement of the narrower 1.6-mile El Calderon road would also be accomplished with an elevated prism, which would require importation of road material (and little disturbance of bedrock). Construction of trails proposed in the area would disturb soil, not bedrock.

**Zuni-Acoma/Acoma-Zuni Trail** – Improvement of the first 0.1 -mile of existing trail on the west end for wheelchair access would be done by importing fill rather than cutting into bedrock. There would be no impacts to geological resources on the east end of the trail.

**Las Ventanas** – Construction of the new .1-mile 20-foot-wide paved spur road to the Las Ventanas trailhead off of the existing Sandstone Bluffs road would be largely in soil and use fill in low areas rather than cutting into sandstone bedrock. The new trail leading

northward to Las Ventanas from the parking area along ridges to the area of the kivas would be relatively low standard, mostly on soil with a few short segments directly on naturally exposed bedrock. No impacts on bedrock are expected. There would be no differences in impacts on geological resources between options 1 and 2.

**Sandstone Bluffs** – Paving the existing gravel road, redesigning the parking area, and installing vault toilets would require no disturbance of bedrock. In one area where a sharp curve in the road is to be realigned, disturbance of the underlying sandstone would be avoided. A wheelchair-accessible trail between the parking area and the sandstone ledges at the top of the cliffs would require installation of a stone or concrete surface that is visually compatible with the surrounding environment. The only possible disturbance of rock would be drilling holes in the sandstone to support interpretive signs.

**The Narrows** – Rock surfaces would not be disturbed to build the six-space parking area adjacent to NM 117. A wheelchair-accessible ramp and a short boardwalk to the viewpoint might require drilling holes in the basalt. The primitive trail onto the **McCartys** flow beyond the viewpoint would be on the flow surface, and the only impact on geologic resources would be local gathering of boulders to make cairns along the route.

**McCartys Crater Viewpoint** – Should option 1 be selected, construction of a .3-mile 20-foot-wide paved spur road between NM 117 and the new parking area, and a short trail to a viewpoint of the crater would be undertaken. The road and parking area would be on alluvial soils, and the trail leading up the ridge to the observation point would be mainly on shallow rocky soil rather than disturbing the underlying sandstone. Impacts on geologic resources would be minimal.

If option 2 is selected, there would be no impact on geologic resources.

**Roadside Kiosk Along NM 117** – There would be no impact on geologic resources.

**Ice Caves and Lava Tubes.** Continued visitor use of lava tubes would increase the potential for damage within caves, including damage to geologic resources. Proposed research, inventories, monitoring, and a cave management plan would provide basic protection for fragile geologic and hydrologic features of these resources.

Backcountry use in areas containing lava tubes could result in isolated acts of vandalism that would destroy delicate volcanic features. The most fragile geologic resources are lavacicles – pencil-slender masses of lava that hang from the walls and ceilings of some lava tubes. Colorful ceiling and wall “mosaics” and “silver formations” in remote lava tube locations could be scarred by initials or other graffiti. A future backcountry management plan with restrictions on public use of caves as well as public education in visitor centers and through other media would help reduce damage to these delicate geologic features while ensuring that visitors could see examples of outstanding cave formations.

### **Impacts on Soils, Vegetation, and Wildlife**

Use of heavy construction equipment, paving, settling of structures, trenching, grading, and repeated foot and vehicular traffic would result in soil compaction and disturbances to vegetation, soils, and wildlife in and adjacent to proposed construction sites and areas of intense visitor use, particularly on sloping and denuded sites. Erosion would result in a loss of topsoil and alteration of soil strata. Soil compaction would reduce infiltration of water and air into the soil and increase the potential for soil erosion. Over time, reduced infiltration of water and air would alter soil chemistry, which in turn would alter vegetative composition. Water falling on these surfaces would be deflected to adjacent low-lying areas, altering natural flow patterns, soil chemistry, and adjacent plant species and densities. Compacted soils also restrict wildlife burrowing, which would reduce the value of these areas as wildlife habitat.

Use of proper soil erosion reduction techniques; properly designed facilities, roads, and trails, and effective interpretive media would help reduce trampling of vegetation and soil erosion and compaction problems. Use of stockpiled topsoil during reclamation efforts would also help reduce potential soil erosion problems. Interpretive

materials and programs, restrictive signing, routine ranger patrols, and night closures of some high-use areas (such as Sandstone Bluffs and the Bandera visitor center/trading post complex area) would also help reduce impacts on resources.

Monumentwide, development and use of facilities would result in the removal of approximately 63 acres of vegetation/soil/wildlife habitat. Overall disturbances would be minimal, affecting approximately .05 percent of monument vegetation/soils/habitat (see table 14). Disturbed habitat would affect primarily ground-and tree-dwelling invertebrates, rodents, and birds. Some animals, including mammals, invertebrates, and birds, would be temporarily or permanently displaced because of construction noise and increased visitor use. Revegetation of about 30 acres adjacent to new roads and facilities (including restoration of the Corral road, portions of Route 42, the Bat Cave road, and backcountry vehicular ways) would offset the 63 acres affected by new construction and would allow for recovery/restoration of soil and reduce erosion problems, as would reclamation of the cinder mine and borrow pits. All revegetation would be done with native plant species, which would restore natural resource values of the sites.

Following construction, increased visitation and use of the multiagency center, Bandera Crater area, Sandstone Bluffs, East Rendija, Zuni-Acoma/Acoma-Zuni Trail, McCartys Crater viewpoint, the Narrows, and El Calderon would result in increased adjacent disturbances to soil and vegetation from foot traffic. Some low-growing plants susceptible to disturbance by trampling – grasses, forbs, lichen, ferns, and cacti – would be affected. Disturbed areas would be susceptible to invasion of exotic plant species such as cheatgrass, tumbleweed, and Russian thistle. Native increasers (species that spread when areas are disturbed) such as rabbitbrush, snakebrush, and cholla would also spread, reducing the potential for reestablishment of a natural vegetative density.

Some animals could become habituated to human presence following construction. Certain species, such as black bear, are often attracted to human food sources; problem animals might have to be removed, which could result in their death. Animal-proof trash containers at developed areas would reduce the potential for habituation of wildlife

**TABLE 14: SUMMARY OF VEGETATION/SOILS/WILDLIFE HABITAT IMPACTED (ACRES)**

<u>Proposed Development Site</u>	<u>Preferred Alt.</u>	<u>Minimum Rea. Alt.</u>
Multiagency center	10.00	10.00
Bandera Crater/Lava Crater	25.50	6.00
East Rendija	19.00	—
Braided Cave	.30	—
El Calderon	3.50	—
Zuni-Acoma/Acoma-Zuni Trail	.50	.50
Las Ventanas	1.00	—
Sandstone Bluffs	.30	.03
The Narrows	.80	—
McCartys Crater viewpoint (option 1)	1.30	—
Roadside Kiosk along NM 117	.50	.50
Total	62.70	17.03
Percent of Monument Affected	.05	.01

to human-food sources. Additional vehicular traffic would result in increased wildlife road kills.

Hedgehog cactus, abundant on the lava, produces clusters when mature and is very popular with collectors. Cactus collection could become a problem as visitation increases.

A determination would be made about the appropriateness of reintroducing bighorn sheep to the monument.

Overall, vegetation/soils/wildlife impacts would be minimal and localized; there would be no significant long-term effect on monumentwide populations or soils. Following are site-specific impacts on vegetation, soils, and wildlife.

**Multiagency Center.** Development of access and the center itself would result in disturbance of approximately 10 acres of the grass/shrub vegetation class<sup>44</sup> and associated soils. Impacts to wildlife would be minimal because the site is not notable wildlife habitat. Previous and existing

disturbances such as the I-40 corridor, Grants development, grazing, and other man-related activities have decreased the value of this area as wildlife habitat.

**Bandera Crater/Lava Crater Area.** Construction of the trail system would result in impacts to approximately 3.5 acres of lava, shrub/conifer, mixed conifer, and ponderosa parkland vegetation, associated wildlife habitat, and soils. Development of the visitor center, the area around the trading post complex, parking areas, and the **NPS** maintenance and residential area would disturb about 7.5 acres of mixed conifer vegetation and associated soil and wildlife habitat. Construction of the visitor center would impact approximately 2.0 acres of pinyon-juniper woodland and ponderosa parkland vegetation and associated soil/wildlife habitat. Construction of the one-way tour road would require substantial soil, habitat, and vegetation disturbance through this narrow sandstone/lava ecotone (5 acres). The other roads in the area (maintenance, entrance, exit, and Dripping Lava Cave road) would disturb an

44. The vegetation classes used in the following description are the same as those that are listed in the "Affected Environment" section under vegetation.

additional 5.5 acres. Construction of buried utility lines would disturb about 2 acres of vegetation, soil, and wildlife habitat. To the extent surface drainage and groundwater patterns are disturbed, vegetative species composition along the new roads could change. Aspen, oak, and various forb species could be replaced by species requiring less water such as pine and juniper. Soils along the one-way tour route and on Sandstone Ridge are moderately to highly erodible, and use of erosion prevention techniques would reduce adverse impacts.

Development of leachfields at the NPS housing area and Bandera visitor center would result in local increases in soil moisture and nutrients. This would alter soil chemistry and vegetation composition at these sites. A dense growth of vegetation at the site would result.

Bears frequent this area of the monument, and human/bear encounters could become a problem. Other wildlife, including burrowing species, would be impacted by the displacement and possible demise of some individuals during facility construction.

**East Rendija Area.** Improvements and realignments to Route 42 and the parking areas would result in impacts to approximately 17 acres of shrub/conifer and mixed conifer vegetation/soils/habitat. Construction of trails would impact approximately 2.0 acres. Disturbances would be similar to those described above.

increased foot traffic into Big Skylight and Four-Window caves and Seven Bridges and Caterpillar collapses would impact fragile cave vegetation, including moss, lichens, and ferns. Surface vegetation such as cactus would be subject to trampling and illegal collection.

**Braided Cave Area.** A marked route to Braided Cave would increase visitation and result in trampling of lichens, cacti, and shrub/conifer vegetation. Illegal cactus collection could also occur. Approximately .3 acres of vegetation/habitat would be removed to establish a small parking area.

**El Calderon Area.** Widening the El Calderon road would disturb approximately 2.0 acres of mixed conifer vegetation/habitat and associated soils. Approximately 1.2 acres of shrub/conifer vegetation/soil/habitat would be disturbed by new road development between Junction Cave and Bat

Cave, including parking areas. Trails would disturb about .3 acre of shrub/conifer vegetation soil/habitat. Lichens and other cave entrance vegetation could be trampled by visitors. About 4 acres of vegetation would be restored after closing the Corral road and the abandoned segment of the Bat Cave road.

If visitors continue to enter the Bat Cave, the Mexican free-tailed bat colony would probably continue to decline, resulting in the eventual loss of this colony. With the proposed plan, however, visitors would not be entering the cave and would be watching the flights from a safe distance. The signs explaining the dangers to the bats and visitors would reduce the number of visitors going into the cave, as would a more controlled viewing experience and the presence of monument personnel. The reasons for the bat population decline in Bat Cave is unknown; however, it is assumed that closing the cave to visitation would help stem the decline. If this does not prove to be the case, additional protection measures (fencing and increased patrols) would be initiated.

**Zuni-Acoma/Acoma Zuni Trail.** The grass/shrub vegetation at the west access and the mixed conifer and lava vegetation along the trail would not be impacted by the minor upgrade of trailhead facilities. The impacts on 0.5 acre of land on the east side from construction of a the parking area and trailhead would also be minor.

**Las Ventanas.** Selection of option 1 would result in disturbance to approximately 0.5 acre of soil/vegetation/habitat for road and parking construction and 0.5 acre for trail development (both impacting the sparse/bare vegetation class).

Impacts from selection of option 2 would be very similar to option 1. The difference would be a slight increase in disturbance to soils, vegetation, and wildlife from removal of backfill and stabilization of the tower kiva.

**Sandstone Bluffs Overlook.** Continued visitor use and associated disturbances would continue to reduce the potential for raptors to nest and other wildlife to inhabit the bluffs. Site improvements would result in removal of approximately .3 acre of sparse/bare vegetation mixed with pinyon-juniper and associated soil and wildlife habitat.

**The Narrows.** About 0.5 acre of grass/shrub vegetation, soils, and wildlife habitat would be removed for the proposed parking area. Construction of the trail would impact approximately .3 acre of grass/shrub and lava vegetation and associated soil/habitat. Impacts to cacti and lichen might be a problem because of trampling by off-trail hikers and illegal cactus collection.

**McCartys Crater Viewpoint.** Selection of option 1 would remove approximately 1.3 acres of shrub/conifer vegetation and related soil/habitat.

Selection of option 2 would result in no impacts on natural resources because no development would occur under this option.

**Roadside Kiosk Along NM 117.** Approximately 0.5 acre of soils and grass/shrub vegetation, soils, and wildlife habitat would be impacted by construction and use of the kiosk and parking.

### **Impacts on Threatened and Endangered Species**

A preconstruction survey and evaluation of the development sites and a monumentwide survey for threatened and endangered species would inform managers about the status of these special species. If any of these species are identified, protective measures would be developed in consultation with the USFWS and state agencies. No known adverse effects on federal or state endangered or threatened species would occur from implementation of the preferred alternative.

### **Impacts on Water Resources**

As facilities are developed and visitor use increases, so also will the demand for domestic water increase. Use of a well in the **Bandera Crater/Lava Crater** area would result in loss of a relatively small quantity of groundwater; however, the overall impact on the area's groundwater supply would be minimal with no long-term consequences. Most water from rain and snow enters porous volcanic soils directly; there is a general paucity of flowing or standing groundwater in all of the monument. The development and use of groundwater from deeper aquifers would result in only minor impacts on ground water quality and quantity in the region. Low-consumptive water use

facilities would reduce the potential impact on the area's groundwater resources.

### **Impacts on Floodplains and Wetlands**

No facilities or visitor use areas are proposed in floodplain or wetland areas; therefore there would be no impacts.

### **Impacts on Air Quality**

Overall effects on the monument's air quality would be short-term and minor, including localized increases in dust and exhaust fumes from construction activities. Vehicular use associated with increased visitation and NPS operations would result in minor seasonal increases in vehicular pollutants, primarily dust. Increased dust along dirt roads would result in the decreased vigor of some roadside plant species.

The overall air quality values of the monument would not be affected. No state or federal air quality standards would be violated.

### **Impacts on Visual Quality**

New facilities would result in increased levels of visual intrusion, the intensity depending on density and height of adjacent vegetation, terrain, and facility design, size, and location. Buildings, roads, and parking areas would be the most intrusive, while trails would be much less intrusive. Careful facility planning and design would alleviate impacts on visual quality at and around development sites.

The closure of ways and the restoration of the Corral road, portions of the Bat Cave road and Route 42, and the backcountry vehicular ways would improve visual quality of these areas. Revegetation with native species would also aid in restoring the visual integrity of the sites.

The boundary proposal for the multiagency center site protects an adequate southern viewshed. In the **Bandera** area, the trading post and Ice Cave stairway would still be noticeable from the top of Cerro **Bandera**; however, improvements would be designed to blend with the surrounding environment. The new visitor center, housing and maintenance facilities, access roads, parking areas,

and trails may intrude on the views from Sandstone Ridge and Lava Crater. Elimination of the sight of vehicles and dust on the section of Route 42 that would be closed would improve the visual quality for visitors in the Bandera area.

In the East Rendija area, the new parking and trailhead areas would be a local visual intrusion. In the El Calderon area, because roads already exist in the area, proposed development (including the new road and other road improvements) would be local intrusions to the visual quality in the area. At Las Ventanas the construction of a parking area, spur road, trailhead, and trail would result in local visual intrusion in the area. Because of little expansion of the existing development at Sandstone Bluffs overlook, there would be minimal additional disturbance of visual quality, except the viewing area structure, which could be a minor visual intrusion if it is built. The new facilities at the Narrows would be a minor visual intrusion on this area, which now contains no development; however, the new parking area and trail could be a visual intrusion from the proposed BLM overlook on the cliff above the site. The new access road and parking at McCartys Crater viewpoint would be a local visual intrusion to visitors.

Reclamation efforts would restore the resource values and visual integrity of the cinder mine and borrow pit areas.

### **Impacts on Audio Quality (Natural Quietness)**

Construction of new facilities would result in minor, short-term, construction-related noise. Increased visitation would result in minor degradation of audio quality primarily at visitor facilities.

## **IMPACTS ON THE CULTURAL ENVIRONMENT**

Implementing the preferred alternative for cultural resource management would result in the collection of important information about the monument's cultural resources and the development of plans and guides that are necessary for improved decisions about protecting and managing those resources. These resources and management concerns include the cultural landscape; national register properties; looting, vandalism, and degradation of the resources; existing conditions of the resources; effective interpretation; and

management of the cultural resources collection. Consultation with American Indians on various subjects would ensure attention to their concerns and ensure improved communication and trust between the Park Service and the American Indians.

Under the preferred alternative, additional law enforcement personnel and increased patrols would deter illegal looting and vandalism. Sites and areas most vulnerable to looting and vandalism would be identified, and increased protection and monitoring would be achieved through agreements with private owners, state and other federal agencies, and Indian tribes.

Coordinating law enforcement with other agencies and providing training for monument employees and volunteers would help law enforcement efforts. Changing a few placenames so as to avoid implications of the presence of important cultural resources would also help ensure protection of some sites.

Because 83 percent of the monument has been determined to be suitable for wilderness (see "Wilderness Suitability Study"), these lands will now be managed as wilderness. This will prohibit certain road access in remote portions of the lava flows and limit the number of visitors who would impact remote archeological and ethnographical resources.

Close coordination between the Park Service and the Bureau of Land Management in program development and operations would ensure effective resource management.

The proposed boundary adjustment, preceded by BLM or NPS cultural resource inventories, would not limit or impede access for American Indians. Appropriate mitigation measures would be taken if cultural resources were discovered.

### **General Impacts of Development and Visitor Use on the Cultural Environment**

Proposed construction could directly affect unknown subsurface archeological resources by disturbing and compacting soils and damaging artifacts and site context. Improved access and concentrations of visitors would lead to secondary impacts, those from informal trails and illegal collection. However, construction would be planned

to avoid areas of known cultural resources, and surveys, investigations, inventories, and evaluation of integrity and significance would be conducted to prescribe mitigations prior to final comprehensive design. These mitigations would also be performed in areas surrounding development areas to avoid secondary impacts. Careful planning and design would also help ensure that facilities would be in character with historic properties and their settings and the cultural landscape.

In special cases, limiting or blocking visitor access or site visibility would reduce site vulnerability. Well-defined self-guiding trails would discourage visitors from leaving established routes and collecting or inadvertently disturbing resources. Public involvement programs would help change attitudes about responsibility for protection of archeological resources.

Adaptive reuse and proper stabilization and maintenance of historic structures, as well as preparation of historic structures reports and preservation guides and conducting archeological research would help preserve these resources.

In all cases, design, closures, relationships between use and trespass, and traditional Indian uses would be discussed with concerned American Indians during planning and prior to design of facilities; this would ensure mutually satisfactory decisions regarding resource protection, development, and use. Preparation of interpretive information in consultation with American Indians would help ensure accurate and sensitive public presentations and also ensure that American Indian cultures would be interpreted as part of the whole El Malpais cultural landscape.

### **Site-Specific Impacts on the Cultural Environment**

**Multiagency Center.** Construction of the multiagency center and associated roads, utilities, parking, and landscaping might impact unknown archeological sites on the 10 acres required for these facilities. Secondary impacts might occur at sites outside the construction zone because of increased visitation and use. Some of this area has been previously impacted by dumping and use of informal roads, and no archeological sites have been reported here. American Indian groups do not appear to have any special concerns for traditional

resources and sites in this area. All cultural resources investigations, evaluations and mitigations (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

**Bandera Crater/Lava Crater Area.** Developments covering approximately 25 acres, (including construction of a new visitor center, employee housing, maintenance facilities, roads, trails, parking, and utilities at the Bandera Crater/Lava Crater area) and increased visitor use might disturb known archeological resources and would likely impact unknown archeological resources during construction. Visitors exploring lava tubes, including Dripping Lava Cave, might encounter archeological resources. However, some roads and trails would follow previously established corridors. All cultural resources investigations, evaluations, and mitigations, including consultation with the State Historic Preservation Office (as described previously) would precede comprehensive design, and construction would avoid sites. This would include secondary impact areas. Because the Bandera area would be one of the top two priorities for intensive survey and documentation, the potential for disturbing sites would be reduced.

The abandoned sawmill site, dumps, and ruins of cabins in the vicinity of the proposed visitor center would be removed; however, archeological investigations, documentation, and mapping would precede removal.

Old trails on the lava near Bandera Crater could continue to impact known and unknown archeological sites. These sites would be surveyed, mapped, and their significance evaluated.

Adaptive use of the structures at the historic trading post complex would comply with section 110 of the National Historic Preservation Act, provide a rewarding interpretive opportunity for visitors and help protect the structures from fire, theft, and vandalism. Routine maintenance would ensure early detection and repair of structural deterioration, helping to preserve the historic fabric. Elimination of a short section of the existing roadway, changes in original vehicular patterns, and addition of new facilities could visually impact the historic trading post complex and remove landscape elements that were part of the historic scene.

Existing parking will be left in place along the east side of the complex, and careful site design and screening would ensure that modern additions do not visually intrude upon the historic scene. Prior to development, the existing roadways and any historic traces of earlier routes will be documented to NPS Historic American Building Survey standards.

Modification of trails and the viewing area at the Ice Cave to provide for wheelchair accessibility might change the appearance of both the trails and the viewing area. However, modifications would be kept to the minimum necessary for safety and accessibility.

Heavy visitation of the Ice Cave and Bandera Crater could interrupt American Indian religious activities. However, most religious use here will occur in winter when there are few visitors. Closures would be worked out between the American Indian groups and the superintendent, as necessary.

**East Rendija Area.** Development, including the improvements to Route 42, would disturb approximately 19 acres; secondary use might be expected to affect a larger area. Unrecorded archeological sites in the East Rendija area might be impacted by roads and trails. Wherever possible, development of roads, trails, and campsites would avoid sites and, as previously described surveys, investigations, mitigation, and compliance would precede development. Plans for trail design and access would be discussed with concerned American Indians. The secondary impacts of visitor use as previously described would be mitigated by archeological surveys, documentation, evaluation, and avoidance strategies. Monitoring programs and previously described mitigation strategies would help ensure site protection.

**Braided Cave Area.** Areas set aside for the unimproved dirt parking area, trails (consisting of about .3 acre total), and the cave itself would be investigated archeologically as described earlier. Secondary impact areas would also be investigated. Preliminary archeological investigations would help mitigate impacts on known and unknown sites.

**El Calderon Area.** New road construction and improvements (totaling about 2.5 miles), parking

areas, and trail construction might impact sites. However, sites near Bat Cave, Double Sinks, Junction Cave, and other local lava flow features as well as the trails and roads proposed for construction or improvement would receive comprehensive investigation, documentation, and compliance prior to development and increased visitor use.

Areas of secondary impact would include easily accessed lava features, El Calderon volcano, and the corridors and destinations along existing roads and informal foot trails. These would also be fully investigated, and appropriate mitigating measures would be taken.

It is probable that many archeological sites exist in this area, but their status is generally unknown. Surveys and monitoring would help avoid and protect sites wherever possible.

**Zuni-Acoma/Acoma-Zuni Trail.** Visitor use may be impacting archeological resources along the trail corridor, including some resources that are important to contemporary American Indians; however, surveys, inventories, and site evaluations would help mitigate some of these impacts. Additional markers would guide visitors around sensitive natural and cultural resources. Consultation with American Indians would also help determine which, if any, short segments of the trail would be realigned to protect resources and prevent trespass. The Park Service would continue to use the permitting process to direct visitors to areas of particular interest while minimizing impacts on fragile resources.

**Las Ventanas/Sandstone Bluffs.** Implementation of the preferred alternative might disturb known and unknown archeological sites along the length of the bluffs, a total area of approximately 1.25 acres. The proposed spur road, parking area, and trail to Las Ventanas particularly have the potential to impact archeological sites. Because the entire area from Sandstone Bluffs overlook north to the natural arch and the Las Ventanas site would be one of the top two priorities in the monument for intensive survey and documentation, the potential for disturbing sites would be reduced.

Because Las Ventanas is special to American Indians, and because sensitive sites need to be avoided, consultation with concerned groups, especially the **Acoma**, would be conducted prior to

construction. Also, because Las Ventanas is on the national register, the State Historic Preservation Office would be consulted to help develop mitigation procedures.

Construction of roads, parking, trails, waysides, etc. would be preceded by archeological investigations as previously described, including reevaluation of prior archeological work. Closure of the Las Ventanas/Sandstone Bluffs road at night would provide privacy for American Indian users and help protect archeological sites.

Careful trail and exhibit design (in part, warning visitors about the sensitive resources) would provide effective interpretive information while helping to protect sites from secondary impacts of visitor use. Waysides would be visually compatible with the character of the site to avoid intrusion on the historic scene.

Removal of fill in the tower kiva, under option 2, would allow visitors to see details of its original construction. This option would, however, increase the cost of maintenance and protection significantly and could contribute to loss of scientific data. Unstable masonry and cultural deposits would be exposed to erosion, creating a preservation problem. The interior of the tower kiva would hold rain and snow, causing the masonry and interior plaster to deteriorate. Differential pressure from unequal soil levels would cause kiva walls to shift inward. Long-term visitor use and exposure to the elements would make a high level of cyclic maintenance and site protection necessary. Artifacts would need to be analyzed and curated.

Archeological, architectural, and religious values that contribute to the integrity and significance of the site would be of primary concern during removal and stabilization of the fill. Following removal of fill, measures would be taken to protect exposed artifacts from erosion and vandalism. Preparation of a historic structures report, including plans for preserving the remaining kiva wall plaster before the project begins, would help mitigate impacts; backfill might be left in some areas of the kiva to protect and preserve this plaster, or alternative treatments could be developed. Drainage controls would be installed to prevent ponding inside the kiva and deterioration caused by the differential soil levels. Cyclic maintenance would be necessary.

Because Las Ventanas is listed on the National Register of Historic Places, proposals for the removal of the backfill and for wall stabilization would also be included in discussions with the New Mexico State Historic Preservation Office. Concerned American Indians would be consulted, and development of interpretive media in consultation with the Acoma would help ensure appropriate exhibits.

Investigations and evaluation of the old stone buildings in the general vicinity of Sandstone Bluffs would ensure proper treatment.

**The Narrows.** Careful archeological investigations and surveys, as described earlier, and consultation with the Pueblo of Acoma would ensure appropriate use of the area and avoid trespass or privacy problems.

**McCartys Crater Viewpoint.** Under option 1, the trails, access road, and viewpoint would disturb about 1.3 acres. Precautions as previously described would be taken prior to construction (there is a historic site in the vicinity). Option 2, no development, would not affect the area's cultural resources.

**Roadside Kiosk along NM 117.** There would be no known impacts to cultural resources from this facility; however the area would be surveyed for potential cultural resources prior to design.

### **Impacts on Museum Collection**

The monument's museum collection would be properly protected and preserved. Necessary plans to guide the acquisition, management, and storage of the collection would be proposed. The new collections storage space in Grants would have the security and environmental controls to meet applicable NPS curatorial standards for those items stored there; items with specialized curatorial requirements would be transported to the NPS Western Archeological and Conservation Center for proper curation.

The proposed actions would protect all collections from fire, theft, and atmospheric degradation and ensure legal compliance. The longevity of museum materials would be increased, and better accountability, accessibility, and orderly retrieval of materials would be ensured.

Possible acquisition of objects and furnishings would ensure that memorabilia actually associated with early-day tourism at Bandera Crater would be available for interpretation to visitors. Use of authentic period furnishings for the cabins at Bandera would help interpretation of a realistic and nostalgic view of early 20th century tourism and recreation in this area.

## IMPACTS ON AMERICAN INDIANS

Increased visitation might make it more difficult for American Indians to conduct traditional activities in privacy and might intensify impacts on cultural sites that have significance to tribes. Visitors might accidentally trespass on Indian lands. Mitigation would include site monitoring, closure of specific areas, employee training and sensitivity programs, public education and information, and other programs as described in the "Plan for Cultural Resources Management." El Malpais managers have already begun a system to contact and consult with concerned groups.

There may be concerns by Indian groups about continuing access to religious sites or other important resources. These problems would be worked out by continued consultation between the monument staff and the concerned tribe. The monument might want to use the Native American Consultation Committee (discussed in the "Plan for Cultural Resources Management" section) as a forum where such concerns can be aired.

Proposals to clear and thin understory, allow wildland fires to burn in prescribed areas, or reclaim and revegetate certain areas could impact certain resources traditionally gathered by American Indians. For this reason, the fire and vegetation management plans would be developed in consultation with concerned Indian peoples. Timely completion of a traditional use study would help guide development of future resource plans.

Although there are no known ethnographic sites in areas of proposed major development, construction projects could disturb religious activities and sites. Concerned groups would be consulted prior to initiation of such projects, and measures to protect sites and religious privacy would be developed.

## IMPACTS ON VISITORS

In compliance with the law, the preferred alternative would provide a multiagency center and a Bandera visitor center. The multiagency center would provide a local and regional information function, orienting visitors to attractions in El Malpais National Monument/National Conservation Area as well as travel opportunities in the region and those related to the Masau Trail. The Bandera visitor center would be the primary focus for interpretive activities in the monument. These two facilities would provide a quality of orientation, information, and interpretation commensurate with the high quality of similar presentations in other units of the national park system. Visitors would have the opportunity to leave the monument with an understanding of its significance. If implemented, this alternative would also establish other programs of visitor use, including education that would comply with the intent of the establishing legislation.

The preferred alternative would improve access and interpretation at the following sites: Bandera Crater area (including Dripping Lava Cave/Lava Crater, Ice Cave, Bandera Crater, Sandstone Ridge, Spattercone Valley, Cerro Bandera, and the surface features trail); the East Rendija area, including the lava wall, Big Skylight and Four-Window caves, Seven Bridges and Caterpillar collapses, and the proposed campground; El Calderon, including Junction Cave, Double Sinks, and Bat Cave; the Zuni-Acoma Trail (east side and, if an easement is acquired, the west side); Sandstone Bluffs overlook; Las Ventanas; the Narrows; and possibly McCartys Crater. (These

sites are described in the "Visitor Services/ Interpretation Plan" section.)<sup>45</sup>

The preferred alternative would provide opportunities for the average visitor (in a two-wheel drive, low-clearance vehicle) to visit four major resource areas that would not be readily accessible in the minimum requirements alternative – Dripping Lava Cave/Lava Crater, East Rendija, Las Ventanas, and the Narrows. The preferred alternative would also disperse use within the monument and give most visitors more opportunities to see firsthand the size and diversity of El Malpais. With dispersed use, visitors should have more frequent opportunities for solitude. The larger number of recreational and interpretive opportunities should increase the visitor's length of stay at El Malpais. At least two days would be needed for visitors to experience all of the interpretive stops and trails offered in the preferred alternative. The proposed on-site activities would familiarize visitors with features that represent most of the major natural and cultural themes of the monument. Most visitors would be able to see a variety of features that complement the visitor center presentations. The hiker with additional time would have numerous opportunities to explore the diverse resources found in El Malpais.

The realignment of Route 42 would enhance the safety of visitors to the west district of the monument. The sight distance along NM 53 would be greatly improved for those motorists turning onto that highway from Route 42.

## **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of the preferred alternative would result in a number of social and economic impacts to the area surrounding El Malpais National Monument. A major effect of the plan on the socioeconomic environment would be added expenditures by monument visitors in local

communities. Although it is currently not possible to determine an exact dollar impact of the creation of the monument on the local economy, expenditures associated with tourism and recreation could be substantial.

The local economy would also receive indirect benefits from visitor expenditures. The amount of money spent by tourists in a given area can be expected to be respent (or multiplied), thus creating additional input to the local economy. Research has determined that regional multipliers for expenditures on recreation-related goods and services have averaged about 2.0 for the past two decades (Walsh 1986). There is little indication that this trend will change in the near future.

Increases in local tourism could also benefit the economies of Indian tribes whose lands are near El Malpais. As visitors to El Malpais receive information on local tourism programs, more of them will likely visit adjacent communities like Acoma, Laguna, Ramah, and Zuni.

A second impact on the economy is the number of people who would be employed by the monument and the expenditures they make locally. The preferred alternative projects that the equivalent of 10.3 additional FTEs (see "Staffing" section) would be employed at the monument. The expenditures of these individuals and their families can also be expected to multiply several times.

Some of the positions (both permanent and seasonal) could be filled by qualified individuals from the immediate El Malpais area. Additionally, new private sector jobs could be created as monument visitation increases. For example, one study has found that three to four additional jobs are created in the local area for every 10 park/monument jobs (Dean et al. 1978). These new private sector jobs arise from the indirect effect of government expenditures on monument payroll and maintenance and from the expenditures of visitors at local businesses. Any new jobs, monument or

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45. To briefly refresh the reader's memory, the Bandera Crater area offers the best opportunity in the monument for seeing the greatest diversity of lava surface features, including Dripping Lava Cave (with its unusual dripping lava formations, the largest tube in overall proportions in El Malpais), the Ice Cave, and Bandera Crater (the largest and most impressive crater in the monument). Cerro Bandera is the highest point in the monument and offers a panoramic view of a vast volcanic region from the top. The ambience and history behind the trading post complex in the Bandera Crater area is also unique. The lava features at East Rendija are distinctly different from but complementary to the volcanic features at the Bandera Crater area.

private sector, could serve marginally to decrease the local unemployment rate.

Additional economic inputs could be expected from the construction of monument facilities. The development of monument facilities would be accomplished through construction contracts that would be awarded through a competitive bid process. Local companies would be eligible to submit proposals through this process, and if selected could accrue financial gains that would add to the local economy. If nonlocal firms win construction contracts, the economy would likely receive benefits through expenditures on lodging, meals, supplies, and incidental items. It should be noted that any economic impacts resulting from the construction phase of monument development would be relatively short-lived in duration.

Annual expenditures for supplies and other monument operation needs would also provide an economic benefit to the El Malpais area. Although many supplies would be procured through centralized government contracts with out-of-area businesses, some items would have to be purchased in the local communities. The monument would also require services such as telephone, electricity, and garbage removal from local providers.

Because the National Park Service would lease privately owned office and storage space in Grants, these additional expenditures would also benefit the local economy.

An increase in the number of visitors to the area could necessitate improvements to the infrastructure of local communities (such as street improvement or expansion of the water and sewage systems). These improvements might require an initial capital outlay, but should be offset in the long term by an increase in tourism expenditures. An increase in tourism might also require hiring additional civil servants (police officers, street maintenance workers, etc.) to ensure that community services are maintained at appropriate levels.

Surveying and identifying the boundary would aid in the protection of monument resources and help control potential illegal woodcutting, hunting and poaching, and potential disputes with adjacent landowners.

The proposed boundary adjustment in the area of the multiagency center site would cause the withdrawal of that land immediately adjacent to the I-40 corridor from possible future private development. Because of its proximity to the interstate, this land could have considerable potential for the development of commercial establishments such as restaurants, service stations, or motels. However, there are other lands adjacent to or very near I-40 in the Grants area that have equal potential for commercial development.

## IMPACTS OF THE MINIMUM REQUIREMENTS ALTERNATIVE

### INTRODUCTION

This section evaluates the impacts of implementing the minimum requirements alternative, including impacts on the natural and cultural environments, impacts on visitors, and impacts on the socioeconomic environment.

### IMPACTS ON THE NATURAL ENVIRONMENT

Because implementation of the plan of natural resource and wildlife management would be the same under the minimum requirements alternative, the impacts would be the same as for the preferred alternative.

#### General Impacts from Development and Visitor Use on the Natural Environment

General impacts from development and visitor use would be the same as for the preferred alternative except that there would be less development and therefore less impact. Construction and use of facilities associated with the minimum requirements alternative would impact approximately 17 acres or .01 percent of the monument.

#### Impacts on Geological Resources

Except for impacts described below, impacts on geological resources would be the same as under the preferred alternative. Because there would be no new development at East Rendija, El Calderon, Las Ventanas, the Narrows, or McCartys Crater viewpoint, there would be no new impacts to bedrock at these sites.

**Bedrock.** Under this alternative, there would be less impact on bedrock because of less development being proposed. Site-specific impacts are described below.

**Multiagency Center** – Impacts on geologic resources would be the same as for the preferred alternative.

**Bandera Crater/Lava Crater Area** – Paving the existing two-way graded road south from NM 53 to the alternate visitor center site and realigning the southern portion of the road toward the east would result in new disturbance of a layer of cinder on sandstone/limestone bedrock over a distance of .2 miles. The southern realigned portion would be on slopes, requiring side-hill excavation of the underlying sedimentary bedrock to a maximum depth of 3 feet (but probably averaging 2 feet), thereby removing about 350 cubic yards, which would probably be used as fill elsewhere during construction in order to balance material. The result would be long, 1- to 3-foot-high cuts exposing light-colored bedrock over a distance of .2 mile along the lower western slope of Sandstone Ridge. Including the .4-mile road between NM 53 and the proposed residential/maintenance areas, the .8-mile exit road from the trading post to NM 53, and the proposed parking areas, a total of 3.9 acres of bedrock would be disturbed. The new parking area at the visitor center would be on more than one level and also would be bordered on its up-slope side by cuts of similar appearance. The visitor center would be in similar terrain and require disturbance of an unknown volume of cinder and underlying sedimentary bedrock.

The residential and maintenance areas, totaling 2.1 acres, would be disturbed by construction, landscaping, and trenches for power, water and sewer lines, and treatment fields. The cinder and other bedrock underlying this area would be removed to depths up to 6 feet, and most would be used for backfill and landscaping in the construction sites.

Impacts of trail construction under this alternative include the following:

Replacing the stairway into the Ice Cave and addition of a handicap viewing area would require removal of small quantities of basalt bedrock to level platform areas and drill holes for structural support.

Regrading and slight realignment of the existing trail to the Ice Cave to make it wheelchair-accessible and of an even grade would require removal of about 50 cubic yards of basalt bedrock. Using portions of the existing routes would be a significant mitigating factor in reducing disturbance to geologic features.

Stone steps into Dripping Lava Cave would be made of loose boulders gathered in the local area, disturbing surface rocks and possibly talus slopes. Fragile “lavacicles” hanging from the walls and ceilings of the cave could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**Zuni-Acoma/Acoma-Zuni Trail** -There would be no impacts on geologic resources at either the west or east ends.

**Sandstone Bluffs** – Provision of a wheelchair-accessible trail between the parking area and the higher sandstone ledges at the top of the cliffs would require installation of a stone or cement surface that is visually compatible with the area. The only possible disturbance of rock would be drilling holes in the sandstone to support the interpretive signs.

**Ice Caves and Lava Tubes.** Proposed research, monitoring, and protection of lava tubes and ice caves would help preserve fragile geologic and hydrologic features.

### **Impacts on Soils, Vegetation, and Wildlife**

Impacts from implementation of the minimum requirements alternative would result in similar impacts on vegetation, soils, and wildlife as described under in the preferred alternative except that the monumentwide area of disturbance would be less (see table 14). Under this alternative about 17 acres would be impacted, which is .01 percent of the total monument; however, about half of those 17 acres would be revegetated. Because no new facilities are proposed for East Rendija, McCartys Crater, Braided Cave, the Zuni-Acoma Trail (west end), Las Ventanas, the Narrows, or El Calderon

there would be no new impacts on soils/vegetation/wildlife/wildlife habitat in these areas.

Because the development would be the same under this alternative as under the preferred alternative, impacts at the multiagency center site, Acoma-Zuni Trail (east end), and the roadside kiosk along NM 117 would be the same.

**Bandera Crater/Lava Crater Area.** Impacts would be similar to the preferred alternative except the area of impact would be less, about 6 acres instead of 25.5 acres. Developing the area immediately east of the Candelaria trading post for the visitor center and using the existing access would limit most construction impacts to areas that have been previously disturbed. Impacts to Dripping Lava Cave would be minimal because it would not be developed as a major visitor attraction.

**Sandstone Bluffs Overlook.** The existing Sandstone Bluffs access road would not be paved under this alternative. Minor realignment of an existing sharp curve would result in less than 1 acre of disturbance to grass/shrubland vegetation.

### **Impacts on Threatened and Endangered Species**

No known adverse effects on federal or state endangered or threatened species would occur from implementation of this alternative.

### **Impacts on Water Resources**

impacts on water resources would be the same as for the preferred alternative.

### **Impacts on Floodplains and Wetlands**

No facilities or visitor use areas are proposed in floodplain or wetland areas; therefore there would be no impacts.

### **Impacts on Air Quality**

Impacts on air quality would be the same **as** for the preferred alternative; however, the lower scale of development would result in less air quality degradation.

## Impacts on Visual Quality

The impacts on visual quality under this alternative would be significantly less compared to the preferred alternative because there would be less development—there would be no new development at East Rendija, Braided Cave, Las Ventanas, the Narrows, and McCartys Crater viewpoint. In the Bandera Crater area there would be less development; however, retention of Route 42 on the east side of Cerro Bandera would result in continued sight of vehicles and dust along this segment by visitors on the Bandera Crater trail.

## Impacts on Audio Quality (Natural Quietness)

With less development proposed than under the preferred alternative, short-term, construction-related noise would be significantly less. As under the preferred alternative, increased visitor use in developed areas would result in more noise.

## IMPACTS ON THE CULTURAL ENVIRONMENT

Because implementation of the plan for cultural resource management is the same under the minimum requirements alternative, the impacts would be the same as under the preferred alternative.

### General Impacts from Development and Visitor Use on the Cultural Environment

General impacts of development and visitor use on cultural resources presented in the preferred alternative are also applicable to this alternative for the sites with the same proposed development: they will not be repeated here. The one exception would be less staff and therefore less deterrent to illegal looting and vandalism. Because the minimum requirements alternative proposes less development, there would be fewer overall impacts, primary and secondary, on cultural resources.

### Site-Specific Impacts on the Cultural Environment

**Multiagency Center.** Impacts would be the same as under the preferred alternative.

**Bandera Crater/Lava Crater Area.** Construction of the new visitor center immediately east of the existing trading post complex would disturb about the same acreage as under the preferred alternative. Construction of the maintenance and housing facilities would occur on the same site for both alternatives, and the impacts would be the same. Construction might affect unknown subsurface archeological resources at the visitor center and residential area sites by disturbing and compacting soils, damaging artifacts, and irreversibly altering the context of buried archeological remains,

In this alternative, new roads and trails would be fewer in number and in length than under the preferred alternative, disturbing about 3 acres less terrain, and there would be fewer impacts. Total ground disturbance for all developments at the Bandera Crater area is estimated at 6 acres. All cultural resources investigations, evaluations, and mitigations, including consultations with the State Historic Preservation Office and American Indians (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

Although they would not be removed under this alternative, the abandoned sawmill site, dumps, and ruins of cabins in the Bandera area would be investigated and documented prior to increased visitor activity.

Old trails and ways as well as recorded and unrecorded archeological sites might be impacted by continued visitor use in the area. These impacts would be assessed by surveys, mapping, and evaluation of the sites.

Treatment and adaptive use of the historic trading post complex in the vicinity of Bandera Crater would be the same as under the preferred alternative with the exception that no cabins would be adapted for use as restrooms. Careful site design, section 106 compliance, and consultation with American Indians would be the same as under the preferred alternative. However, because the new visitor center would be closer to the historic structures at the trading post, special attention to site and building designs would be needed. Despite such mitigations, the large volume of use, including increased parking area capacity for both the visitor center and the trading post/crater/Ice Cave area

would tend to concentrate more visitors close to the trailhead and could affect the historic ambience in the area.

**Zuni-Acoma/Acoma-Zuni Trail.** There would be no new impacts to the Zuni-Acoma Trail (west end) under this alternative. Impacts and mitigating measures for the Acoma-Zuni Trail (east end) would be the same as under the preferred alternative.

**Las Ventanas/Sandstone Bluffs.** Under this alternative, no new impacts are expected, except that the access road would be closed at night to help protect sites and ensure privacy for American Indian religious activities. Consultation with American Indians would continue in order to protect sites from visitor impacts.

Las Ventanas is on the National Register of Historic Places, and measures for protecting and managing this area would be included in discussions with the State Historic Preservation Office.

**Roadside Kiosk Along NM 117.** Impacts would be the same as under the preferred alternative.

### **Impacts on Museum Collection**

The monument's museum collection, including new storage space, would be managed and protected in the same way as described in the preferred alternative; therefore the impacts would be the same.

### **IMPACTS ON AMERICAN INDIANS**

The impacts on American Indians would be the same as under the preferred alternative.

### **IMPACTS ON VISITORS**

This alternative (like the preferred) would provide a multiagency center and a Bandera Crater visitor center. The impacts on visitors at these two centers would be the same as under the preferred alternative.

Under the minimum requirements alternative, the Bandera Crater area (including only the Ice Cave, Bandera Crater, and a surface features trail) and

Sandstone Bluffs overlook would be the only two major improved and interpreted sites available, and most visitors would have little chance for solitude because of the concentration of visitors at these two areas. Access to Dripping Lava Cave, the East Rendija area, the El Calderon area, and the Narrows would be possible by existing roads (high-clearance vehicles only) or primitive trails. The Corral road would remain open and the El Calderon road that accesses the national conservation area south of the monument boundary would not be improved, i.e., access would continue to be by the existing roads, which are often muddy in the winter. Las Ventanas, one of the monument's most significant cultural sites and an important primary visitor opportunity under the preferred alternative would not be accessible to the general public. Overall, under this alternative access would be provided to fewer resources. The hiker who is willing to commit time would have numerous opportunities to explore the diverse resources of El Malpais. However, most visitors would have far less exposure to the resources necessary to complement the visitor center presentations in conveying the primary interpretive themes of the monument.

Compared to the preferred alternative, the visitor experience in the Bandera area would be far more directly oriented to the Ice Cave and Bandera Crater, and the visitor would enter quickly from NM 53 and almost immediately be at the main resource, with no time to approach the trading post area over a special road that allows for leisurely viewing of the volcanic terrain in the area. Also, fewer trails would be available; visitors wishing to see Dripping Lava Cave would be required to hike over a long primitive trail.

The preservation of Route 42 along its existing alignment would result in no new impacts; the minimal sight distance for motorists turning onto NM 53 from Route 42 would continue.

### **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of this alternative would result in socioeconomic impacts that are similar to those described under the preferred alternative. The minimum requirements alternative would require a staff increase of only 3.7 FTEs (6.6 less than under the preferred). Thus, expenditures in the local

communities by monument employees would be proportionately less.

The minimum requirements alternative also proposes a somewhat lower level of visitor facilities as compared to the preferred alternative. This might result in fewer recreationists being attracted to the monument or in visitors staying for shorter periods of time. The effect would be a proportional decrease in the magnitude of economic benefits received from tourism expenditures.

## SUMMARY OF IMPACTS

The following table presents a summary comparison of the impacts of the two alternatives.

**TABLE 15: SUMMARY COMPARISON OF IMPACTS**

<b>Preferred Alternative</b>	<b>Minimum Requirements Alternative</b>
<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>	<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>
Various studies and monitoring programs would provide information for more efficient management of the monument's natural resources.	Same as preferred
Detailed action plans would enable managers to perpetuate the fauna and flora as part of a total ecosystem; baseline data would help managers identify future changes and avoid adverse impacts to monument resources.	Same as preferred
More staff would be available for patrols and resource protection.	Less staff available and less protection than under preferred.
<b>Impacts on Geological Resources</b>	<b>Impacts on Geological Resources</b>
Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 4,750 cubic yards of bedrock covering 13 acres.	Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 1,300 cubic yards of bedrock covering 2.1 acres.
<b>impacts on Soils/Vegetation/Wildlife</b>	<b>impacts on Soils/Vegetation/Wildlife</b>
Removal of 63 acres of soils/vegetation and wildlife habitat would affect only .05 percent of the monument. About 30 acres would be restored to natural conditions. Disturbed areas would be susceptible to invasion of exotic species. Wildlife impacts would be localized and temporary, with no significant long-term effects. With closure of Bat Cave to visitors, bat habitat would be better protected.	Impacts would be similar to the preferred, but less in degree and in fewer areas. Removal of 17 acres of soils/vegetation would affect only .01 percent of the monument. About 8 acres would be restored.
Careful site design and revegetation would minimize impacts on soils, vegetation, and wildlife.	Same as preferred
Reclamation of cinder pits and vehicular ways would reduce erosion and restore native vegetation.	Same as preferred
<b>Impacts on Threatened and Endangered Species</b>	<b>impacts on Threatened and Endangered Species</b>
No impacts on known federal or state endangered or threatened species.	Same as preferred

### **Impacts on Water Resources**

Temporary impacts on surface water quality during construction and minor impacts of groundwater because of long-term consumption.

### **Impacts on Floodplains and Wetlands**

No impacts.

### **Impacts on Air Quality**

No impact on overall air quality; short-term dust and fumes during construction. Monitoring air quality would provide the information necessary to maintain the monument's class II air quality.

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design). Overall improvement because of the closure and revegetation of the cinder pits and vehicular ways.

Realignment of northern part of Route 42 would eliminate visual impacts of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Minor short-term noise from facility construction.

### **IMPACTS ON CULTURAL RESOURCES**

Construction potentially affecting unknown archeological resources, to be mitigated by surveys, site avoidance, etc. Overall, development would have few impacts. Impacts of use to be mitigated by careful design, site monitoring, public education, and law enforcement. More staff would help deter looting and protect resources.

Consultation with American Indians would improve decisions about development, resource protection, interpretation, and use. Effective communication between the Park Service and American Indians would help resolve conflicts, establish trust, and perhaps create new methods of NPS management. Temporary closure of some areas would ensure American Indian religious privacy. Access ensured for subsistence activities.

Collections would be stored consistent with NPS policies, secure from theft, fire, and other adverse environmental conditions.

Sites vulnerable to looting, vandalism, and ordinary visitor activities would be identified and prioritized for protection.

Interpretation of cultural landscape concept would elicit visitor assistance in resource protection.

### **Impacts on Water Resources**

Same as preferred

### **Impacts on Floodplains and Wetlands**

Same as preferred

### **impacts on Air Quality**

Same as preferred

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design), but less than under preferred. Overall improvement because of the closure and revegetation of cinder pits and vehicular ways.

No realignment of Route 42; continued visual impact of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Same as preferred, although less because of less development.

### **IMPACTS ON CULTURAL RESOURCES**

Same as preferred except less potential for disturbance to archeological resources. Less staff available and less protection available than under preferred.

Same as preferred

Same as preferred

Same as preferred

Same as preferred

Adaptive use of trading post complex would support long-term preservation of this historic resource.

Same as preferred

Option 1: Minor impacts at Las Ventanas site. Consultation with Acoma, surveys, careful design, and patrols would minimize impact. Consultation with the State Historic Preservation Office would also take place.

No impact

Option 2: Removal of backfill from the tower kiva at Las Ventanas could diminish its integrity and significance, would be costly, and would contribute to deterioration of structural elements and artifacts. Mitigation would include consultation with Acoma and the state of New Mexico and implementation of historic preservation studies and procedures.

No impact

Eventual survey and evaluation of the total monument resource would enable managers to formulate the most practicable protection strategies.

Same as preferred

### **IMPACTS ON AMERICAN INDIANS**

### **IMPACTS ON AMERICAN INDIANS**

Visitors might unintentionally intrude on American Indian traditional activities, trespass on Indian lands, or disturb significant cultural sites. Mitigation could include monitoring, closure, education/information programs, and consultation with concerned groups.

Same as preferred

Resource management plans could affect resources traditionally used by Indians. Traditional use studies and consultation would help guide resource management. Construction projects could disturb religious activities and sites. Consultation and measures to protect sites and religious privacy would occur prior to construction.

### **IMPACTS ON VISITORS**

### **IMPACTS ON VISITORS**

High quality orientation, information, and interpretation would provide the public a safe and enjoyable visit and ensure an understanding of the monument's significance. Two visitor centers to initiate the visitor experience and nine developed areas with trails, overlooks, and waysides covering many features and themes would be available.

Same as preferred, except only two developed areas with structured activities would be available. Most visitors would be denied access to the highly significant Las Ventanas site.

Would disperse use in several areas and give visitors opportunities for both structured experiences and solitude.

Most visitor use would concentrate at **Bandera** Crater and Sandstone Bluffs where there would be more crowding and less opportunity for solitude.

Safer built environment for visitors at several sites.

Same as preferred, but fewer sites.

Primitive campground for longer-term visitors who want to explore the backcountry.

No campground available.

Route 42 improvement would make access to East Rendija safer and more reliable. Passenger cars would be able to reach East Rendija.

Continued unreliable access for motorists on Route 42, depending on fair weather. Only high-clearance vehicles could reach East Rendija.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Increasing expenditures by monument visitors in local communities.

10.3 additional full-time-equivalent employees plus families would increase expenditures in the local communities.

Some NPS employees hired from the local area if qualified.

New private sector jobs would result.

Financial gains to local companies from possible construction awards or from local expenditures by other contractors. These would be short-term benefits.

Local expenditure for leased office space in Grants.

About 54 additional acres north of multiagency center site would not be available for commercial development.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Same as preferred, however fewer visitors and less economic benefit to communities from tourist expenditures.

Only 3.7 additional full-time-equivalent employees plus families would benefit local economy.

Fewer NPS employees hired.

Fewer private sector jobs would result.

Same as preferred, but fewer contracts and expenditures.

Same as preferred

Same as preferred

# WILDERNESS SUITABILITY STUDY

## INTRODUCTION

The purpose of wilderness designation, which is accomplished solely by congressional action, is to preserve and protect wilderness characteristics and values over the long term while providing opportunities for solitude and unconfined recreation. With passage of the 1964 Wilderness Act (16 USC 1131 et seq.), Congress declared that it is national policy to secure for present and future generations the benefits of enduring wilderness resources.

Section 501 .(c) of the El Malpais legislation states that, "The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all roadless lands within the boundaries of the monument." The purpose of this study, then, is to evaluate and identify monument lands that possess wilderness characteristics as defined in the Wilderness Act and NPS *Management Policies*.

## WILDERNESS DEFINITION

The Wilderness Act describes and defines a wilderness area as follows:

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in the Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive

and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

## CRITERIA FOR WILDERNESS

Chapter 6 of the NPS *Management Policies*, "Wilderness Preservation and Management," states that wilderness includes

lands and waters found to possess the characteristics and values of wilderness, as defined in the Wilderness Act

lands that have been logged, farmed, grazed, or otherwise utilized in ways not involving extensive development or alteration of the landscape. (These lands will be considered for wilderness if at the time of study the effects of these activities are substantially unnoticeable or their wilderness character could be restored through appropriate management actions.)

The policies continue to say that lands will not be excluded from wilderness because of the following:

Management practices require the use of tools, equipment, or structures if those practices are necessary for the health and safety of wilderness travelers or protection of the wilderness area.

The lands contain prior rights or privileges, such as livestock grazing and stock driveways, provided these operations do not involve the routine use of motorized or mechanical equipment and do not involve development and structures to such an extent that the human imprint is substantially noticeable.

An area possesses mineral rights and may be subject to exploration and development if it is likely that the mineral rights will be

relinquished, acquired, exchanged, or otherwise eliminated in the foreseeable future.<sup>46</sup>

The lands contain underground utility lines if these lines do not require the routine use of mechanized and motorized equipment. (Areas containing aboveground utility lines do not meet wilderness criteria.)

There are historic features in an area that attract visitors primarily for the enjoyment of solitude and unconfined recreation. (An area will not qualify if it contains historic features that are considered primary visitor attractions.)

Section 501 (c) of the “El Malpais Senate Report,” July 6, 1987, provides further guidance. The report states that

It is the intention of the Committee that the National Park Service apply the same criteria for determining which lands are ‘roadless’ as would be applied by the BLM; that is, the definition of ‘road’ found in the BLM’s wilderness inventory policy should be used.

The Bureau of Land Management defines a “road” as “a vehicle route which has been improved and maintained by mechanical means to ensure relatively regular and continuous use.” The BLM definition of a “way” is “a vehicle route which has not been improved and maintained by mechanical means to ensure relatively regular and continuous use.” Therefore, areas of the monument containing vehicular “ways” as defined by the Bureau of Land Management are considered “roadless” by the intent of the Senate report.

The monument contains several vehicular routes that clearly meet the definition of a “way,” which classifies these areas as “roadless.” The ways were created to provide backcountry access for early timber and livestock grazing operations. These routes are a significant resource problem (see “The Plan for Natural Resource and Wildlife

Management” section), resulting in compacted soil and erosion problems. The ways serve no particular purpose except to provide infrequently used routes for backcountry visitors. Some are nonroutinely used by ranchers for maintaining livestock grazing operations. As previously stated, this commercial grazing, which is authorized by Congress, will be discontinued after December 31, 1997.

## INTERIM MANAGEMENT OF SUITABLE LANDS

All lands determined suitable for wilderness designation will be managed under the provisions of the Wilderness Act and NPS policies to maintain wilderness characteristics and values. Interim wilderness management will continue until designation by Congress.

Section 501 .(c) (2) of the El Malpais establishing legislation states

Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary [of the Interior], through the Director of the National Park Service, shall manage all roadless lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System.

## BRIEF DESCRIPTION OF THE STUDY AREA

Approximately 95 percent of the monument is covered by rugged lava fields, which, along with the limited availability of water, have historically restricted human access and development and limited the exploitation of resources.

In contrast, the more accessible grass/shrubland and forested areas along the lava flow margins have historically been used and contain most of the evidence of historic development. These areas contain national and regional transportation routes

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46. The establishing legislation for the monument provided for BLM exchange of state and privately owned subsurface interests under federally owned lands including the monument. All state subsurface exchanges have been completed. Private exchanges are continuing. Interests yet to be acquired are shown on the Wilderness Suitability map. More detailed information can be found in the El Malpais **Land Protection Plan**.

including US 40, NM 117, NM 53, and Route 42; they have also been heavily grazed and, in the northwestern portion of the monument, heavily timbered. Most visual intrusions in the monument are associated with these activities and include roads and ways, buildings, overhead power and telephone lines, earthen and metal stock tanks, fences, windmills, and corrals.

The monument is bordered on two sides by designated wilderness areas -the 60,000-acre Cebolla Wilderness to the southeast and the 38,210-acre West Malpais Wilderness to the southwest. Additionally, the 17,468-acre Chain of Craters Wilderness Study Area, approximately 2.5 miles west of the monument, is under study for possible wilderness designation. All of these areas are in the national conservation area and are managed by the Bureau of Land Management.<sup>47</sup>

## WILDERNESS SUITABILITY

Using the wilderness criteria previously described, an evaluation of the monument was conducted by the Park Service, and approximately 95,811 acres or 83 percent of the monument was found to possess wilderness characteristics and values (see Wilderness Suitability map). The suitable areas include large portions of the major lava flows, including the McCartys, Laguna, and Bandera flows and contain no permanent improvements, have only minor human impacts, and provide outstanding opportunities for solitude and unconfined recreation. They also contain important ecological, geological, archeological, educational, scientific, scenic, or historic resources. Other acreages identified as suitable are the lava fringe areas along the southwestern monument boundary that adjoin the West Malpais Wilderness Area, forming an adjacent NPS/BLM wilderness boundary.

Monument lands that do not possess wilderness qualities and values and have been determined unsuitable for wilderness designation include approximately 19,076 acres or 17 percent of the monument. These areas include the following:

The 1089.70-acre noncontiguous multiagency center site<sup>48</sup> just south of I-40 near Grants – This site does not meet wilderness criteria because of nearby development and small size.

Approximately 152 acres of lands adjacent to roadways – Setbacks in these areas define the wilderness suitability boundary. The setbacks limit visual and audible intrusions while allowing for road improvements and realignments. The setbacks will vary with the type and standard of road, including 300 feet from centerline of paved roads, 100 feet from centerline of high-standard dirt or gravel roads, and 30 feet from centerline of low-standard dirt roads.

The road corridor to Cerro Encierro, which encompasses approximately 17 acres – This road provides administrative and public access to the monument's otherwise inaccessible southwestern Laguna lava flow. The road is necessary for fire, search-and-rescue, and resource management operations. It also provides a primitive vehicular recreational opportunity unavailable elsewhere in the monument.

Approximately 17,815 acres of the lava fringe areas – These areas include proposed development sites such as East Rendija, El Calderon, Sandstone Bluffs, Las Ventanas, the Zuni-Acoma/Acoma-Zuni trailheads, the Narrows, and McCartys Crater viewpoint. This acreage also contains most of the roads that provide motorized access for monument protection and management, American Indian subsistence and religious purposes, and ranching operations (to be discontinued by 1998).

## POTENTIAL WILDERNESS ADDITIONS

Potential wilderness lands are those areas surrounded by or adjacent to wilderness that meet the criteria and would be suitable for wilderness

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47. For a detailed description of monument resources see the "Affected Environment" section of this document.

48. With the proposed boundary adjustment, this figure would be approximately 484 acres.

designation if in federal ownership. However, because these lands are not currently in federal ownership and because federal acquisition of these private lands may or may not become a reality, these lands are identified as potential wilderness additions for the purposes of this study only. The Park Service will try to work cooperatively with these landowners to protect the wilderness qualities of their lands. Within the boundaries of El Malpais National Monument there are approximately 18,079.53 acres of private lands, 10,925 acres of which are potential wilderness additions (see Wilderness Suitability map).

### IMPLICATIONS OF MANAGING LANDS IDENTIFIED AS SUITABLE FOR WILDERNESS<sup>49</sup>

As previously described, all lands that have been found suitable for wilderness designation will be managed as wilderness until such time as Congress specifically designates wilderness at El Malpais National Monument. This entails the closure of all ways and ensures no use of motorized or mechanical equipment, including mountain bikes, motorcycles, and chain saws (by both visitors and monument staff). Travel will be by foot, horseback, or pack animal only. Caves with entrances in wilderness-suitable land will be managed as wilderness. Also, development within suitable wilderness will be limited to the those facilities determined necessary to carry out the objectives as defined in the Wilderness Act and NPS **Management Policies**. The construction of facilities incompatible with wilderness values or management objectives will be prohibited. (The existing intrusive and incompatible livestock ranching developments will be removed following discontinuation of grazing on December 31, 1997, provided that none of the structures are determined historic.)

Travel within the areas suitable for wilderness will be more difficult and require greater planning and effort. Elimination of routine mechanized and motorized usage will not be an inconvenience to livestock operators because existing ranching operations do not require routine mechanized or

motorized use within areas determined to be suitable for wilderness.

The establishing legislation states that traditional American Indian practices may continue in El Malpais, consistent with the Wilderness Act. The Wilderness Act excludes use of motorized vehicles and equipment in wilderness areas, and nonexclusive access will be by foot, horseback, or other types of pack animals. Certain locations within the areas suitable for wilderness may be periodically closed to the general public for short periods for American Indian purposes. (Coordination with the superintendent will be necessary to arrange such closures.) Otherwise, there are no important differences in the ways American Indians may use lands suitable for wilderness in the national monument. It should be noted that, with few exceptions, most of the area suitable for wilderness has no roads, so designation as wilderness-suitable lands should not change traditional use patterns.

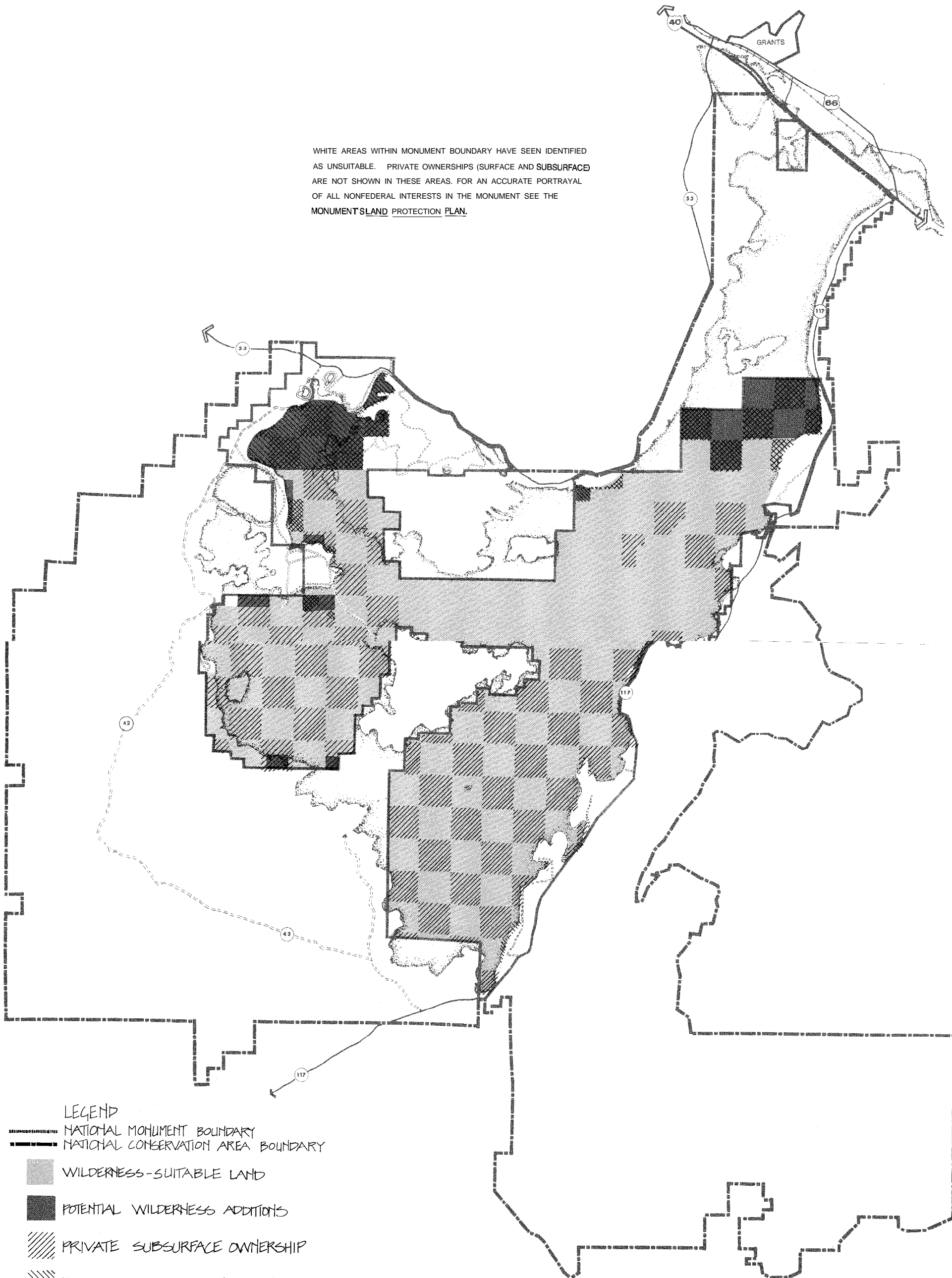
Research scientists who were required to camp in wilderness-suitable areas for prolonged periods would be required to accept primitive camping conditions and use of minimum equipment. Scientists wanting to inventory and conduct other research activities, including those associated with archeology, would be restricted in their scope of work. This would include the requirements that their projects would be allowed only if there is no other alternative to their research in wilderness-suitable areas and their projects would not interfere with other uses except for short duration. Electronic monitoring devices to protect cultural resources would be allowed only if determined to be the minimum necessary tool.

The Park Service would provide public information and interpretation about wilderness values, fostering an appreciation of these values. Visitors would be required to accept the land largely on its own terms, accepting certain risks that are inherent to primitive recreation (including potential danger from adverse weather and extremely rugged terrain). NPS interpretation and safety information would partly mitigate these hazards.

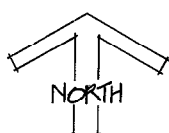
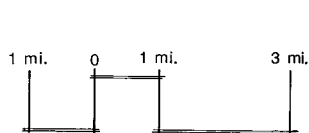
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49. Management zoning, described earlier, restricts many of the same activities and uses that the designation as wilderness suitable restricts (see appendix C).

WHITE AREAS WITHIN MONUMENT BOUNDARY HAVE BEEN IDENTIFIED AS UNSUITABLE. PRIVATE OWNERSHIPS (SURFACE AND SUBSURFACE) ARE NOT SHOWN IN THESE AREAS. FOR AN ACCURATE PORTRAYAL OF ALL NONFEDERAL INTERESTS IN THE MONUMENT SEE THE MONUMENT'S LAND PROTECTION PLAN.



- LEGEND
- NATIONAL MONUMENT BOUNDARY
  - NATIONAL CONSERVATION AREA BOUNDARY
  - WILDERNESS-SUITABLE LAND
  - POTENTIAL WILDERNESS ADDITIONS
  - PRIVATE SUBSURFACE OWNERSHIP
  - PRIVATE SURFACE OWNERSHIP
  - PRIVATE SURFACE/SUBSURFACE OWNERSHIP



## WILDERNESS SUITABILITY

EL MALPAIS NATIONAL MONUMENT

U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/DEC 1989/103/20,020 A

As described in the natural resource and wildlife management section, a wilderness management plan will be developed by the superintendent to guide the preservation, management, and use of the area. The plan will be developed with public involvement and will contain specific, measurable wilderness management objectives for the preservation of wilderness values as specified in the Wilderness Act and NPS Management *Policies*.

There may be a slight increase in visitors seeking wilderness recreation experiences; however, this increase will not significantly benefit the local economy or add to the region's recreation opportunities.

Wilderness designation, and in this case determination of lands suitable for wilderness, will help ensure long-term perpetuation of wilderness resources and values while providing opportunities for solitude and unconfined recreation. The elimination of vehicles will allow for restoration/ reclamation of disturbed areas, enhance wilderness values, and increase the opportunity for solitude. For those who choose to hike or journey by horseback, opportunities for unconfined recreation will be greatly enhanced.

## CONCLUSION

Most of El Malpais National Monument lands have been found to possess wilderness characteristics and values. This amounts to 95,811 acres or 83 percent of the monument. This total includes potential wilderness additions (wilderness-suitable nonfederal lands as described above).

Based on the analysis of the suitability criteria, the following four categories of land in El Malpais National Monument have been identified with respect to wilderness suitability (see Wilderness Suitability map):

Suitable federal lands	approximately 84,886 acres
Potential wilderness addition& (suitable nonfederal lands)	approximately 10,925 acres
<b>Total suitable lands</b>	<b>95,811 acres</b>
Unsuitable federal lands	approximately 11,575 acres
Unsuitable nonfederal lands	approximately 7,536 acres
<b>Total unsuitable lands</b>	<b>19,111 acres</b>
<b>Total monument land</b>	<b>114.922 acres</b>

## **Federal**

Advisory Council on Historic Preservation  
Bureau of Land Management, Rio Puerco  
and Santa Fe Offices  
U.S. Fish and Wildlife Service, Albuquerque  
U.S. Forest Service  
Southwest Regional Office  
Cibola National Forest  
Apache National Forest

## **State**

Albuquerque Convention and Visitors Bureau  
Albuquerque Department of Economic Development  
New Mexico Department of Game and Fish,  
Santa Fe Office  
New Mexico Economic Development  
and Tourism Department  
New Mexico Energy, Mineral, and Natural  
Resources Department  
New Mexico Energy, Mineral, and Natural  
Resources Department, Parks  
and Recreation Division  
New Mexico State Highway and Transportation  
Department  
New Mexico State Historic Preservation Office  
New Mexico State Tourism Office  
University of New Mexico, Bureau of Business  
and Economic Research

## **County**

Cibola Convention and Visitor Bureau

## **City**

City of Grants  
Gallup Chamber of Commerce  
Greater Grants Chamber of Commerce

## **Indian Tribes**

Pueblo of Acoma  
Pueblo of Laguna  
**Ramah** Navajo Chapter  
Pueblo of Zuni

## APPENDIX A: ESTABLISHING LEGISLATION

PUBLIC LAW 100-225—DEC. 31, 1987

101 STAT. 1539

Public Law 100-225  
100th Congress

### An Act

To establish the El Malpais National Monument and the El Malpais National Conservation Area in the State of New Mexico, to authorize the Masau Trail, and for other purposes.

Dec. 31, 1987  
[H.R. 403]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

#### TITLE I—EL MALPAIS NATIONAL MONUMENT

##### ESTABLISHMENT OF MONUMENT

**SEC. 101. (a)** In order to preserve, for the benefit and enjoyment of present and future generations, that area in western New Mexico containing the nationally significant Grants Lava Flow, the Las Ventanas Chacoan Archeological Site, and other significant natural and cultural resources, there is hereby established the El Malpais National Monument (hereinafter referred to as the “monument”). The monument shall consist of approximately 114,000 acres as generally depicted on the map entitled “El Malpais National Monument and National Conservation Area” numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for public inspection in the offices of the Director of the National Park Service, Department of the Interior. **16 USC 460uu.**

Public  
information.

**(b)** As soon as practicable after the enactment of this Act, the Secretary of the Interior (hereinafter referred to as the “Secretary”) shall file a legal description of the monument with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description and in the map referred to in subsection **(a)**. The legal description shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior.

Public  
information.

##### TRANSFER

**SEC. 102.** Lands and waters and interests therein within the boundaries of the monument, which as of the day prior to the date of enactment of this Act were administered by the Forest Service, United States Department of Agriculture, are hereby transferred to the administrative jurisdiction of the Secretary to be managed as part of the monument in accordance with this Act. The boundaries of the Cibola National Forest shall be adjusted accordingly. **National Forest System. 16 USC 460uu-1.**

##### MANAGEMENT

**SEC. 103.** The Secretary, acting through the Director of the National Park Service, shall manage the monument in accordance with **16 USC 460uu-2.**

101 STAT.1539

the provisions of this Act, the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1 et seq.), and other provisions of law applicable to units of the National Park System. The Secretary shall protect, manage, and administer the monument for the purposes of preserving the scenery and the natural, historic, and cultural resources of the monument and providing for the public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

#### PERMITS

Animals.  
Contracts.  
16 USC 460uu-3.

SEC. 104. Where any lands included within the boundary of the monument on the map referred to in subsection 101(a) are legally occupied or utilized on the date of enactment of this Act for grazing purposes, pursuant to a lease, permit, or license which is-

(a) for a fixed term of years issued or authorized by any department, establishment, or agency of the United States, and

(b) scheduled for termination before December 31, 1997,

the Secretary, notwithstanding any other provision of law, shall allow the persons holding such grazing privileges (or their heirs) to retain such grazing privileges until December 31, 1997, subject to such limitations, conditions, or regulations as the Secretary may prescribe to insure proper range management. No grazing shall be permitted on lands within the boundaries of the monument on or after January 1, 1998.

State and local  
governments.  
Indians.

#### TITLE II-MASAU TRAIL

##### DESIGNATION OF TRAIL

Arizona.  
Federal  
Register.  
publication.  
16 USC  
460uu-11.

SEC. 201. In order to provide for public appreciation, education, understanding, and enjoyment of certain nationally significant sites of antiquity in New Mexico and eastern Arizona which are accessible by public road, the Secretary, acting through the Director of the National Park Service, with the concurrence of the agency having jurisdiction over such roads, is authorized to designate, by publication of a description thereof in the Federal Register, a vehicular tour route along existing public roads linking prehistoric and historic cultural sites in New Mexico and eastern Arizona. Such a route shall be known as the **Masau** Trail (hereinafter referred to as the "trail").

##### AREAS INCLUDED

16 USC  
460uu-12.

SEC. 202. The trail shall include public roads linking El Malpais National Monument as established pursuant to title I of this Act, El Morro National Monument, **Chaco** Cultural National Historical Park, Aztec Ruins National Monument, Canyon De Chelly National Monument, **Pecos** National Monument, and **Gila** Cliff Dwellings National Monument. The Secretary may, in the manner set forth in section 201, designate additional segments of the trail from time to time as appropriate to link the foregoing sites with other cultural sites or sites of national significance when such sites are designated and protected by Federal, State, or local governments, Indian tribes, or nonprofit entities.

## INFORMATION AND INTERPRETATION

SEC. 203. With respect to sites linked by segments of the trail which are administered by other Federal, State, local, tribal, or nonprofit entities, the Secretary may, pursuant to cooperative agreements with such entities, provide technical assistance in the development of interpretive devices and materials in order to contribute to public appreciation of the natural and cultural resources of the sites along the trail. The Secretary, in cooperation with State and local governments, Indian tribes, and nonprofit entities, shall prepare and distribute informational material for the public appreciation of sites along the trail. **16 USC 460uu-13.**

## MARKERS

SEC. 204. The trail shall be marked with appropriate markers to guide the public. With the concurrence and assistance of the State or local entity having jurisdiction over the roads designated as part of the trail, the Secretary may erect thereon and maintain signs and other informational devices displaying the Masau Trail Marker. The Secretary is authorized to accept the donation of suitable signs and other informational devices for placement at appropriate locations. **16 USC 460uu-14.**

## TITLE III—EL MALPAIS NATIONAL CONSERVATION AREA

## ESTABLISHMENT OF AREA

SEC. 301. (a) In order to protect for the benefit and enjoyment of future generations that area in western New Mexico containing the La **Ventana** Natural Arch and the other unique and nationally important geological, archeological, ecological, cultural, scenic, scientific, and wilderness resources of the public lands surrounding the Grants Lava **Flows**, there is hereby established the El Malpais National **Conservation** Area (hereinafter referred to as the “conservation area”). The conservation area shall consist of approximately 262,690 acres of federally owned land as generally depicted on a map entitled “El **Malpais** National Monument and National Conservation Area” numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for inspection in the offices of the Director of the Bureau of Land Management of the Department of the Interior. **16 USC 460uu-21.**

(b) As soon as practicable after the date of enactment of this Act, the Secretary shall file a **legal** description of the conservation area designated under this section with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular **Affairs** of the United States House of Representatives. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The **legal** description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior. **Public information.**

## MANAGEMENT

SEC. 302. (a) The Secretary, acting through the Director of the Bureau of Land Management, shall manage the conservation area to protect the resources specified in section 301 and in accordance with this Act. the Federal Land Management and Policy Act of 1976 **Animals. 16 USC 460uu-22.**

and other applicable provisions of law, including those **provisions** relating to grazing on public lands.

(b) The Secretary shall permit hunting and trapping within the conservation **area** in accordance with applicable laws and **regulations** of the United States and the State of New Mexico; except that the Secretary, after consultation with the New Mexico Department of Game and Fish, may issue regulations designating zones where and establishing periods when no hunting or trapping shall be permitted for reasons of public safety, administration, or public use and enjoyment.

Forests and  
forest  
products.

(c) Collection of green or dead wood for sale or other commercial **purposes** shall not be permitted in the conservation area.

(d) Except as otherwise provided in section **402(b)**, within the conservation area the grazing of livestock shall be permitted to **continue**, pursuant to applicable Federal **law**, including this Act, and subject to such reasonable regulations, policies, and practices as the Secretary deems necessary.

National  
Wilderness  
Preservation  
System.

#### TITLE IV-WILDERNESS

##### DESIGNATION OF WILDERNESS

16 USC  
460uu-31.

SEC. 401. (a) In furtherance of the purposes of the Wilderness Act (78 Stat. 890; 16 U.S.C. 1311, there are hereby designated as wilderness, and, therefore, as components of the National Wilderness Preservation System, the **Cebolla** Wilderness of approximately 60,000 acres, and the West Malpais Wilderness of approximately 38,210 acres, as each is generally depicted on the map entitled "El **Malpais** National Monument and National Conservation Area" numbered NM-ELMA-80,001-B and dated May 1987. The map shall be on **file** and available for inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

16 USC 1132  
note.

Public  
information.

(b) As soon as practicable after the date of the enactment of this Act, the Secretary shall file a legal description of each wilderness area designated by this Act with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be **on** file and available for public inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

##### MANAGEMENT

16 USC  
460uu-32.

SEC. 402. (a) Subject to valid existing rights, each wilderness area designated under this Act shall be administered by the Secretary, through the Director of the Bureau of Land Management, in accordance with the provisions of the Wilderness Act governing areas designated by that Act as wilderness, except that any reference in **such** provisions to the effective date of the Wilderness Act shall be deemed to be **a** reference to the date of enactment of this Act.

Animals.

(b) Within the wilderness areas designated by this Act, the grazing of livestock, where established prior to the enactment of this Act, shall be **permitted** to continue subject to such reasonable regulations, **policies**, and practices as the Secretary deems necessary, as

long as such regulations, policies, and practices fully conform with and implement the intent of Congress regarding grazing in such areas as such intent is expressed in the Wilderness Act and section 108 of Public Law 96-560 (16 U.S.C. 1133 note).

## TITLE V-GENERAL PROVISIONS

### MANAGEMENT PLANS

**SEC. 501. (a)** Within three full **fiscal** years following the **fiscal** year of enactment of this Act, the Secretary shall develop and transmit to the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural Resources of the United States Senate, separate general management plans for the monument and the conservation area which shall describe the appropriate uses and development of the monument and the conservation area consistent with the purposes of this Act. The plans shall include but not be limited to each of the following:

National  
Wilderness  
Preservation  
System.  
16 USC  
460uu-41.

(1) implementation plans for a continuing program of interpretation and public education about the resources and values of the monument and the conservation area;

(2) proposals for public facilities to be developed for the conservation area or the monument, including a visitors center in the vicinity of **Bandera** Crater and a multiagency orientation center, to be located in or near Grants, New Mexico, and adjacent to Interstate 40, to accommodate visitors to western New Mexico;

(3) natural and cultural resources management plans for the monument and the conservation area, with a particular emphasis on the preservation and long-term **scientific** use of archaeological resources, giving high priority to the enforcement of the provisions of the Archeological Resources Protection Act of 1979 and the National Historic Preservation Act within the monument and the conservation area. The natural and **cultural** resources management plans **shall** be prepared in close consultation with the Advisory **Council** on Historic Preservation, the New Mexico State Historic Preservation **Office**, and the **local** Indian people and their traditional cultural and religious authorities; and such plans **shall** provide for long-term scientific use of archaeological resources in the monument and the conservation area, including the wilderness areas designated by this Act; and

Indians.

(4) wildlife resources management plans for the monument and the conservation area prepared in close consultation with appropriate departments of the State of New Mexico and using previous studies of the area.

Wildlife.

**(b)(1)** The general management plan for the conservation area shall review and recommend the suitability or nonsuitability for preservation as wilderness of those lands comprising approximately 17,468 acres, identified as "Wilderness Study Area" (hereafter in this title referred to as the "**WSA**") on the map referenced in section 101.

**(2)** Pending submission of a recommendation and until otherwise directed by an Act of Congress, the Secretary, acting through the Director of the Bureau of Land Management, **shall** manage the

lands within the WSA so as to maintain their potential for inclusion within the National Wilderness Preservation System.

(c)(1). The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all **roadless** lands within the boundaries of the monument as established by this Act except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

(2) Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary, through the Director of the National Park Service, shall manage all **roadless** lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System, except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

#### ACQUISITIONS

Public lands.  
Gifts and  
property.  
16 USC  
460uu-42.

**SEC. 502.** Within the monument and the conservation area, the Secretary is authorized to acquire lands and interests in lands by donation, purchase with donated or appropriated funds, exchange, or transfer from any other Federal agency, except that such lands or interests therein owned by the State of New Mexico or a political subdivision thereof may be acquired only by exchange. It is the sense of Congress that the Secretary is to complete the acquisition of non-Federal subsurface interests underlying the monument and the conservation area no later than three full fiscal years after the fiscal year of enactment of this Act.

#### STATE EXCHANGES

Public lands.  
Gifts and  
property.  
16 USC  
460uu-43.

**SEC. 503. (a)** Upon the request of the State of New Mexico (hereinafter referred to as the “State”) and pursuant to the provisions of this section, the Secretary shall exchange public lands or interests in lands elsewhere in the State of New Mexico, of approximately equal value and selected by the State, acting through its Commissioner of Public Lands, for any lands or interests therein owned by the State (hereinafter referred to as “State lands”) located within the boundaries of the monument or the conservation area which the State wishes to exchange with the United States.

**(b)** Within six months after the date of enactment of this Act, the Secretary **shall** notify the New Mexico Commissioner of Public Lands what State lands are within the monument or the conservation area. The notice shall contain a listing of all public lands or interest therein within the boundaries of the State of New Mexico which have not been withdrawn from entry and which the Secretary, pursuant to the provisions of sections 202 and 206 of the Federal Land Policy and Management Act of 1976, has identified as appropriate for transfer to the State in exchange for State lands. Such listing shall be updated at least annually. If the New Mexico Commissioner of Public Lands gives notice to the Secretary of the State’s desire to obtain public lands so listed, the Secretary shall **notify** the Commissioner in writing as to whether the Department of the **Interior** considers the State lands within the monument or conservation area to be of approximately equal value to the listed lands **or** interests in lands the Commissioner has indicated the State desires to obtain. It is the sense of the Congress that the exchange **of**

lands and interests therein with the State pursuant to this section should be completed within two years after the date of enactment of this Act.

#### MINERAL EXCHANGES

**SEC. 504. (a)** The Secretary is authorized and directed to exchange the Federal mineral interests in the lands described in subsection (b) for the private mineral interests in the lands described in subsection (c), if—

16 USC  
460uu-44

(1) the owner of such private mineral interests has made available to the Secretary all information requested by the Secretary as to the respective values of the private and Federal mineral interests to be exchanged; and

(2) on the basis of information obtained pursuant to paragraph (1) and any other information available, the Secretary has determined that the mineral interests to be exchanged are of approximately equal value; and

(3) the Secretary has determined—

(A) that except insofar as otherwise provided in this section, the exchange is not inconsistent with the Federal Land Policy and Management Act of 1976; and

(B) that the exchange is in the public interest.

(b) The Federal mineral interests to be exchanged under this section underlie the lands, comprising approximately 15,008 acres, depicted as “Proposed for transfer to Santa Fe Pacific” on the map referenced in subsection (d).

(c) The private mineral interests to be exchanged pursuant to this section underlie the lands, comprising approximately 15,141 acres, depicted as “Proposed for transfer to U.S.” on the map referenced in subsection (d).

(d)(1) The mineral interests identified in this section underlie those lands depicted as “Proposed for transfer to Santa Fe Pacific” and as “Proposed for transfer to U.S.” on a map entitled “El Malpais Leg. Boundary, HR3684/S56”, revised 5-8-87.

(2) As soon as practicable after the date of enactment of this Act, the Secretary shall file a legal description of the mineral interest areas designated under this section with the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

(e) It is the sense of the Congress that all exchanges pursuant to this section shall be completed no later than three years after the date of enactment of this Act.

#### ACOMA PUEBLO EXCHANGES

**SEC. 565. (a)(1)** Upon the request of the Pueblo of **Acoma**, the Secretary shall acquire by exchange any lands held in trust for the Pueblo of **Acoma** (hereinafter referred to as “trust lands”) located within the boundary of the conservation area which the Pueblo

Indians.  
Public lands  
16 USC  
460uu-45.

and trails may intrude on the views from Sandstone Ridge and Lava Crater. Elimination of the sight of vehicles and dust on the section of Route 42 that would be closed would improve the visual quality for visitors in the Bandera area.

In the East Rendija area, the new parking and trailhead areas would be a local visual intrusion. In the El Calderon area, because roads already exist in the area, proposed development (including the new road and other road improvements) would be local intrusions to the visual quality in the area. At Las Ventanas the construction of a parking area, spur road, trailhead, and trail would result in local visual intrusion in the area. Because of little expansion of the existing development at Sandstone Bluffs overlook, there would be minimal additional disturbance of visual quality, except the viewing area structure, which could be a minor visual intrusion if it is built. The new facilities at the Narrows would be a minor visual intrusion on this area, which now contains no development; however, the new parking area and trail could be a visual intrusion from the proposed BLM overlook on the cliff above the site. The new access road and parking at McCartys Crater viewpoint would be a local visual intrusion to visitors.

Reclamation efforts would restore the resource values and visual integrity of the cinder mine and borrow pit areas.

### **Impacts on Audio Quality (Natural Quietness)**

Construction of new facilities would result in minor, short-term, construction-related noise. Increased visitation would result in minor degradation of audio quality primarily at visitor facilities.

## **IMPACTS ON THE CULTURAL ENVIRONMENT**

Implementing the preferred alternative for cultural resource management would result in the collection of important information about the monument's cultural resources and the development of plans and guides that are necessary for improved decisions about protecting and managing those resources. These resources and management concerns include the cultural landscape; national register properties; looting, vandalism, and degradation of the resources; existing conditions of the resources; effective interpretation; and

management of the cultural resources collection. Consultation with American Indians on various subjects would ensure attention to their concerns and ensure improved communication and trust between the Park Service and the American Indians.

Under the preferred alternative, additional law enforcement personnel and increased patrols would deter illegal looting and vandalism. Sites and areas most vulnerable to looting and vandalism would be identified, and increased protection and monitoring would be achieved through agreements with private owners, state and other federal agencies, and Indian tribes.

Coordinating law enforcement with other agencies and providing training for monument employees and volunteers would help law enforcement efforts. Changing a few placenames so as to avoid implications of the presence of important cultural resources would also help ensure protection of some sites.

Because 83 percent of the monument has been determined to be suitable for wilderness (see "Wilderness Suitability Study"), these lands will now be managed as wilderness. This will prohibit certain road access in remote portions of the lava flows and limit the number of visitors who would impact remote archeological and ethnographical resources.

Close coordination between the Park Service and the Bureau of Land Management in program development and operations would ensure effective resource management.

The proposed boundary adjustment, preceded by BLM or NPS cultural resource inventories, would not limit or impede access for American Indians. Appropriate mitigation measures would be taken if cultural resources were discovered.

### **General Impacts of Development and Visitor Use on the Cultural Environment**

Proposed construction could directly affect unknown subsurface archeological resources by disturbing and compacting soils and damaging artifacts and site context. Improved access and concentrations of visitors would lead to secondary impacts, those from informal trails and illegal collection. However, construction would be planned

to avoid areas of known cultural resources, and surveys, investigations, inventories, and evaluation of integrity and significance would be conducted to prescribe mitigations prior to final comprehensive design. These mitigations would also be performed in areas surrounding development areas to avoid secondary impacts. Careful planning and design would also help ensure that facilities would be in character with historic properties and their settings and the cultural landscape.

In special cases, limiting or blocking visitor access or site visibility would reduce site vulnerability. Well-defined self-guiding trails would discourage visitors from leaving established routes and collecting or inadvertently disturbing resources. Public involvement programs would help change attitudes about responsibility for protection of archeological resources.

Adaptive reuse and proper stabilization and maintenance of historic structures, as well as preparation of historic structures reports and preservation guides and conducting archeological research would help preserve these resources.

In all cases, design, closures, relationships between use and trespass, and traditional Indian uses would be discussed with concerned American Indians during planning and prior to design of facilities; this would ensure mutually satisfactory decisions regarding resource protection, development, and use. Preparation of interpretive information in consultation with American Indians would help ensure accurate and sensitive public presentations and also ensure that American Indian cultures would be interpreted as part of the whole El Malpais cultural landscape.

### **Site-Specific Impacts on the Cultural Environment**

**Multiagency Center.** Construction of the multiagency center and associated roads, utilities, parking, and landscaping might impact unknown archeological sites on the 10 acres required for these facilities. Secondary impacts might occur at sites outside the construction zone because of increased visitation and use. Some of this area has been previously impacted by dumping and use of informal roads, and no archeological sites have been reported here. American Indian groups do not appear to have any special concerns for traditional

resources and sites in this area. All cultural resources investigations, evaluations and mitigations (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

**Bandera Crater/Lava Crater Area.** Developments covering approximately 25 acres, (including construction of a new visitor center, employee housing, maintenance facilities, roads, trails, parking, and utilities at the Bandera Crater/Lava Crater area) and increased visitor use might disturb known archeological resources and would likely impact unknown archeological resources during construction. Visitors exploring lava tubes, including Dripping Lava Cave, might encounter archeological resources. However, some roads and trails would follow previously established corridors. All cultural resources investigations, evaluations, and mitigations, including consultation with the State Historic Preservation Office (as described previously) would precede comprehensive design, and construction would avoid sites. This would include secondary impact areas. Because the Bandera area would be one of the top two priorities for intensive survey and documentation, the potential for disturbing sites would be reduced.

The abandoned sawmill site, dumps, and ruins of cabins in the vicinity of the proposed visitor center would be removed; however, archeological investigations, documentation, and mapping would precede removal.

Old trails on the lava near Bandera Crater could continue to impact known and unknown archeological sites. These sites would be surveyed, mapped, and their significance evaluated.

Adaptive use of the structures at the historic trading post complex would comply with section 110 of the National Historic Preservation Act, provide a rewarding interpretive opportunity for visitors and help protect the structures from fire, theft, and vandalism. Routine maintenance would ensure early detection and repair of structural deterioration, helping to preserve the historic fabric. Elimination of a short section of the existing roadway, changes in original vehicular patterns, and addition of new facilities could visually impact the historic trading post complex and remove landscape elements that were part of the historic scene.

Existing parking will be left in place along the east side of the complex, and careful site design and screening would ensure that modern additions do not visually intrude upon the historic scene. Prior to development, the existing roadways and any historic traces of earlier routes will be documented to NPS Historic American Building Survey standards.

Modification of trails and the viewing area at the Ice Cave to provide for wheelchair accessibility might change the appearance of both the trails and the viewing area. However, modifications would be kept to the minimum necessary for safety and accessibility.

Heavy visitation of the Ice Cave and Bandera Crater could interrupt American Indian religious activities. However, most religious use here will occur in winter when there are few visitors. Closures would be worked out between the American Indian groups and the superintendent, as necessary.

**East Rendija Area.** Development, including the improvements to Route 42, would disturb approximately 19 acres; secondary use might be expected to affect a larger area. Unrecorded archeological sites in the East Rendija area might be impacted by roads and trails. Wherever possible, development of roads, trails, and campsites would avoid sites and, as previously described surveys, investigations, mitigation, and compliance would precede development. Plans for trail design and access would be discussed with concerned American Indians. The secondary impacts of visitor use as previously described would be mitigated by archeological surveys, documentation, evaluation, and avoidance strategies. Monitoring programs and previously described mitigation strategies would help ensure site protection.

**Braided Cave Area.** Areas set aside for the unimproved dirt parking area, trails (consisting of about .3 acre total), and the cave itself would be investigated archeologically as described earlier. Secondary impact areas would also be investigated. Preliminary archeological investigations would help mitigate impacts on known and unknown sites.

**El Calderon Area.** New road construction and improvements (totaling about 2.5 miles), parking

areas, and trail construction might impact sites. However, sites near Bat Cave, Double Sinks, Junction Cave, and other local lava flow features as well as the trails and roads proposed for construction or improvement would receive comprehensive investigation, documentation, and compliance prior to development and increased visitor use.

Areas of secondary impact would include easily accessed lava features, El Calderon volcano, and the corridors and destinations along existing roads and informal foot trails. These would also be fully investigated, and appropriate mitigating measures would be taken.

It is probable that many archeological sites exist in this area, but their status is generally unknown. Surveys and monitoring would help avoid and protect sites wherever possible.

**Zuni-Acoma/Acoma-Zuni Trail.** Visitor use may be impacting archeological resources along the trail corridor, including some resources that are important to contemporary American Indians; however, surveys, inventories, and site evaluations would help mitigate some of these impacts. Additional markers would guide visitors around sensitive natural and cultural resources. Consultation with American Indians would also help determine which, if any, short segments of the trail would be realigned to protect resources and prevent trespass. The Park Service would continue to use the permitting process to direct visitors to areas of particular interest while minimizing impacts on fragile resources.

**Las Ventanas/Sandstone Bluffs.** Implementation of the preferred alternative might disturb known and unknown archeological sites along the length of the bluffs, a total area of approximately 1.25 acres. The proposed spur road, parking area, and trail to Las Ventanas particularly have the potential to impact archeological sites. Because the entire area from Sandstone Bluffs overlook north to the natural arch and the Las Ventanas site would be one of the top two priorities in the monument for intensive survey and documentation, the potential for disturbing sites would be reduced.

Because Las Ventanas is special to American Indians, and because sensitive sites need to be avoided, consultation with concerned groups, especially the **Acoma**, would be conducted prior to

construction. Also, because Las Ventanas is on the national register, the State Historic Preservation Office would be consulted to help develop mitigation procedures.

Construction of roads, parking, trails, waysides, etc. would be preceded by archeological investigations as previously described, including reevaluation of prior archeological work. Closure of the Las Ventanas/Sandstone Bluffs road at night would provide privacy for American Indian users and help protect archeological sites.

Careful trail and exhibit design (in part, warning visitors about the sensitive resources) would provide effective interpretive information while helping to protect sites from secondary impacts of visitor use. Waysides would be visually compatible with the character of the site to avoid intrusion on the historic scene.

Removal of fill in the tower kiva, under option 2, would allow visitors to see details of its original construction. This option would, however, increase the cost of maintenance and protection significantly and could contribute to loss of scientific data. Unstable masonry and cultural deposits would be exposed to erosion, creating a preservation problem. The interior of the tower kiva would hold rain and snow, causing the masonry and interior plaster to deteriorate. Differential pressure from unequal soil levels would cause kiva walls to shift inward. Long-term visitor use and exposure to the elements would make a high level of cyclic maintenance and site protection necessary. Artifacts would need to be analyzed and curated.

Archeological, architectural, and religious values that contribute to the integrity and significance of the site would be of primary concern during removal and stabilization of the fill. Following removal of fill, measures would be taken to protect exposed artifacts from erosion and vandalism. Preparation of a historic structures report, including plans for preserving the remaining kiva wall plaster before the project begins, would help mitigate impacts; backfill might be left in some areas of the kiva to protect and preserve this plaster, or alternative treatments could be developed. Drainage controls would be installed to prevent ponding inside the kiva and deterioration caused by the differential soil levels. Cyclic maintenance would be necessary.

Because Las Ventanas is listed on the National Register of Historic Places, proposals for the removal of the backfill and for wall stabilization would also be included in discussions with the New Mexico State Historic Preservation Office. Concerned American Indians would be consulted, and development of interpretive media in consultation with the Acoma would help ensure appropriate exhibits.

Investigations and evaluation of the old stone buildings in the general vicinity of Sandstone Bluffs would ensure proper treatment.

**The Narrows.** Careful archeological investigations and surveys, as described earlier, and consultation with the Pueblo of Acoma would ensure appropriate use of the area and avoid trespass or privacy problems.

**McCartys Crater Viewpoint.** Under option 1, the trails, access road, and viewpoint would disturb about 1.3 acres. Precautions as previously described would be taken prior to construction (there is a historic site in the vicinity). Option 2, no development, would not affect the area's cultural resources.

**Roadside Kiosk along NM 117.** There would be no known impacts to cultural resources from this facility; however the area would be surveyed for potential cultural resources prior to design.

### **Impacts on Museum Collection**

The monument's museum collection would be properly protected and preserved. Necessary plans to guide the acquisition, management, and storage of the collection would be proposed. The new collections storage space in Grants would have the security and environmental controls to meet applicable NPS curatorial standards for those items stored there; items with specialized curatorial requirements would be transported to the NPS Western Archeological and Conservation Center for proper curation.

The proposed actions would protect all collections from fire, theft, and atmospheric degradation and ensure legal compliance. The longevity of museum materials would be increased, and better accountability, accessibility, and orderly retrieval of materials would be ensured.

Possible acquisition of objects and furnishings would ensure that memorabilia actually associated with early-day tourism at Bandera Crater would be available for interpretation to visitors. Use of authentic period furnishings for the cabins at Bandera would help interpretation of a realistic and nostalgic view of early 20th century tourism and recreation in this area.

## IMPACTS ON AMERICAN INDIANS

Increased visitation might make it more difficult for American Indians to conduct traditional activities in privacy and might intensify impacts on cultural sites that have significance to tribes. Visitors might accidentally trespass on Indian lands. Mitigation would include site monitoring, closure of specific areas, employee training and sensitivity programs, public education and information, and other programs as described in the "Plan for Cultural Resources Management." El Malpais managers have already begun a system to contact and consult with concerned groups.

There may be concerns by Indian groups about continuing access to religious sites or other important resources. These problems would be worked out by continued consultation between the monument staff and the concerned tribe. The monument might want to use the Native American Consultation Committee (discussed in the "Plan for Cultural Resources Management" section) as a forum where such concerns can be aired.

Proposals to clear and thin understory, allow wildland fires to burn in prescribed areas, or reclaim and revegetate certain areas could impact certain resources traditionally gathered by American Indians. For this reason, the fire and vegetation management plans would be developed in consultation with concerned Indian peoples. Timely completion of a traditional use study would help guide development of future resource plans.

Although there are no known ethnographic sites in areas of proposed major development, construction projects could disturb religious activities and sites. Concerned groups would be consulted prior to initiation of such projects, and measures to protect sites and religious privacy would be developed.

## IMPACTS ON VISITORS

In compliance with the law, the preferred alternative would provide a multiagency center and a Bandera visitor center. The multiagency center would provide a local and regional information function, orienting visitors to attractions in El Malpais National Monument/National Conservation Area as well as travel opportunities in the region and those related to the Masau Trail. The Bandera visitor center would be the primary focus for interpretive activities in the monument. These two facilities would provide a quality of orientation, information, and interpretation commensurate with the high quality of similar presentations in other units of the national park system. Visitors would have the opportunity to leave the monument with an understanding of its significance. If implemented, this alternative would also establish other programs of visitor use, including education that would comply with the intent of the establishing legislation.

The preferred alternative would improve access and interpretation at the following sites: Bandera Crater area (including Dripping Lava Cave/Lava Crater, Ice Cave, Bandera Crater, Sandstone Ridge, Spattercone Valley, Cerro Bandera, and the surface features trail); the East Rendija area, including the lava wall, Big Skylight and Four-Window caves, Seven Bridges and Caterpillar collapses, and the proposed campground; El Calderon, including Junction Cave, Double Sinks, and Bat Cave; the Zuni-Acoma Trail (east side and, if an easement is acquired, the west side); Sandstone Bluffs overlook; Las Ventanas; the Narrows; and possibly McCarty's Crater. (These

sites are described in the "Visitor Services/ Interpretation Plan" section.)<sup>45</sup>

The preferred alternative would provide opportunities for the average visitor (in a two-wheel drive, low-clearance vehicle) to visit four major resource areas that would not be readily accessible in the minimum requirements alternative – Dripping Lava Cave/Lava Crater, East Rendija, Las Ventanas, and the Narrows. The preferred alternative would also disperse use within the monument and give most visitors more opportunities to see firsthand the size and diversity of El Malpais. With dispersed use, visitors should have more frequent opportunities for solitude. The larger number of recreational and interpretive opportunities should increase the visitor's length of stay at El Malpais. At least two days would be needed for visitors to experience all of the interpretive stops and trails offered in the preferred alternative. The proposed on-site activities would familiarize visitors with features that represent most of the major natural and cultural themes of the monument. Most visitors would be able to see a variety of features that complement the visitor center presentations. The hiker with additional time would have numerous opportunities to explore the diverse resources found in El Malpais.

The realignment of Route 42 would enhance the safety of visitors to the west district of the monument. The sight distance along NM 53 would be greatly improved for those motorists turning onto that highway from Route 42.

## **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of the preferred alternative would result in a number of social and economic impacts to the area surrounding El Malpais National Monument. A major effect of the plan on the socioeconomic environment would be added expenditures by monument visitors in local

communities. Although it is currently not possible to determine an exact dollar impact of the creation of the monument on the local economy, expenditures associated with tourism and recreation could be substantial.

The local economy would also receive indirect benefits from visitor expenditures. The amount of money spent by tourists in a given area can be expected to be respent (or multiplied), thus creating additional input to the local economy. Research has determined that regional multipliers for expenditures on recreation-related goods and services have averaged about 2.0 for the past two decades (Walsh 1986). There is little indication that this trend will change in the near future.

Increases in local tourism could also benefit the economies of Indian tribes whose lands are near El Malpais. As visitors to El Malpais receive information on local tourism programs, more of them will likely visit adjacent communities like Acoma, Laguna, Ramah, and Zuni.

A second impact on the economy is the number of people who would be employed by the monument and the expenditures they make locally. The preferred alternative projects that the equivalent of 10.3 additional FTEs (see "Staffing" section) would be employed at the monument. The expenditures of these individuals and their families can also be expected to multiply several times.

Some of the positions (both permanent and seasonal) could be filled by qualified individuals from the immediate El Malpais area. Additionally, new private sector jobs could be created as monument visitation increases. For example, one study has found that three to four additional jobs are created in the local area for every 10 park/monument jobs (Dean et al. 1978). These new private sector jobs arise from the indirect effect of government expenditures on monument payroll and maintenance and from the expenditures of visitors at local businesses. Any new jobs, monument or

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45. To briefly refresh the reader's memory, the Bandera Crater area offers the best opportunity in the monument for seeing the greatest diversity of lava surface features, including Dripping Lava Cave (with its unusual dripping lava formations, the largest tube in overall proportions in El Malpais), the Ice Cave, and Bandera Crater (the largest and most impressive crater in the monument). Cerro Bandera is the highest point in the monument and offers a panoramic view of a vast volcanic region from the top. The ambience and history behind the trading post complex in the Bandera Crater area is also unique. The lava features at East Rendija are distinctly different from but complementary to the volcanic features at the Bandera Crater area.

private sector, could serve marginally to decrease the local unemployment rate.

Additional economic inputs could be expected from the construction of monument facilities. The development of monument facilities would be accomplished through construction contracts that would be awarded through a competitive bid process. Local companies would be eligible to submit proposals through this process, and if selected could accrue financial gains that would add to the local economy. If nonlocal firms win construction contracts, the economy would likely receive benefits through expenditures on lodging, meals, supplies, and incidental items. It should be noted that any economic impacts resulting from the construction phase of monument development would be relatively short-lived in duration.

Annual expenditures for supplies and other monument operation needs would also provide an economic benefit to the El Malpais area. Although many supplies would be procured through centralized government contracts with out-of-area businesses, some items would have to be purchased in the local communities. The monument would also require services such as telephone, electricity, and garbage removal from local providers.

Because the National Park Service would lease privately owned office and storage space in Grants, these additional expenditures would also benefit the local economy.

An increase in the number of visitors to the area could necessitate improvements to the infrastructure of local communities (such as street improvement or expansion of the water and sewage systems). These improvements might require an initial capital outlay, but should be offset in the long term by an increase in tourism expenditures. An increase in tourism might also require hiring additional civil servants (police officers, street maintenance workers, etc.) to ensure that community services are maintained at appropriate levels.

Surveying and identifying the boundary would aid in the protection of monument resources and help control potential illegal woodcutting, hunting and poaching, and potential disputes with adjacent landowners.

The proposed boundary adjustment in the area of the multiagency center site would cause the withdrawal of that land immediately adjacent to the I-40 corridor from possible future private development. Because of its proximity to the interstate, this land could have considerable potential for the development of commercial establishments such as restaurants, service stations, or motels. However, there are other lands adjacent to or very near I-40 in the Grants area that have equal potential for commercial development.

## IMPACTS OF THE MINIMUM REQUIREMENTS ALTERNATIVE

### INTRODUCTION

This section evaluates the impacts of implementing the minimum requirements alternative, including impacts on the natural and cultural environments, impacts on visitors, and impacts on the socioeconomic environment.

### IMPACTS ON THE NATURAL ENVIRONMENT

Because implementation of the plan of natural resource and wildlife management would be the same under the minimum requirements alternative, the impacts would be the same as for the preferred alternative.

#### General Impacts from Development and Visitor Use on the Natural Environment

General impacts from development and visitor use would be the same as for the preferred alternative except that there would be less development and therefore less impact. Construction and use of facilities associated with the minimum requirements alternative would impact approximately 17 acres or .01 percent of the monument.

#### Impacts on Geological Resources

Except for impacts described below, impacts on geological resources would be the same as under the preferred alternative. Because there would be no new development at East Rendija, El Calderon, Las Ventanas, the Narrows, or McCartys Crater viewpoint, there would be no new impacts to bedrock at these sites.

**Bedrock.** Under this alternative, there would be less impact on bedrock because of less development being proposed. Site-specific impacts are described below.

**Multiagency Center** – Impacts on geologic resources would be the same as for the preferred alternative.

**Bandera Crater/Lava Crater Area** – Paving the existing two-way graded road south from NM 53 to the alternate visitor center site and realigning the southern portion of the road toward the east would result in new disturbance of a layer of cinder on sandstone/limestone bedrock over a distance of .2 miles. The southern realigned portion would be on slopes, requiring side-hill excavation of the underlying sedimentary bedrock to a maximum depth of 3 feet (but probably averaging 2 feet), thereby removing about 350 cubic yards, which would probably be used as fill elsewhere during construction in order to balance material. The result would be long, 1- to 3-foot-high cuts exposing light-colored bedrock over a distance of .2 mile along the lower western slope of Sandstone Ridge. Including the .4-mile road between NM 53 and the proposed residential/maintenance areas, the .8-mile exit road from the trading post to NM 53, and the proposed parking areas, a total of 3.9 acres of bedrock would be disturbed. The new parking area at the visitor center would be on more than one level and also would be bordered on its up-slope side by cuts of similar appearance. The visitor center would be in similar terrain and require disturbance of an unknown volume of cinder and underlying sedimentary bedrock.

The residential and maintenance areas, totaling 2.1 acres, would be disturbed by construction, landscaping, and trenches for power, water and sewer lines, and treatment fields. The cinder and other bedrock underlying this area would be removed to depths up to 6 feet, and most would be used for backfill and landscaping in the construction sites.

Impacts of trail construction under this alternative include the following:

Replacing the stairway into the Ice Cave and addition of a handicap viewing area would require removal of small quantities of basalt bedrock to level platform areas and drill holes for structural support.

Regrading and slight realignment of the existing trail to the Ice Cave to make it wheelchair-accessible and of an even grade would require removal of about 50 cubic yards of basalt bedrock. Using portions of the existing routes would be a significant mitigating factor in reducing disturbance to geologic features.

Stone steps into Dripping Lava Cave would be made of loose boulders gathered in the local area, disturbing surface rocks and possibly talus slopes. Fragile “lavacicles” hanging from the walls and ceilings of the cave could be broken during isolated acts of vandalism. This type of damage would be discouraged by public education programs at the visitor centers and in on-site interpretive messages.

**Zuni-Acoma/Acoma-Zuni Trail** -There would be no impacts on geologic resources at either the west or east ends.

**Sandstone Bluffs** – Provision of a wheelchair-accessible trail between the parking area and the higher sandstone ledges at the top of the cliffs would require installation of a stone or cement surface that is visually compatible with the area. The only possible disturbance of rock would be drilling holes in the sandstone to support the interpretive signs.

**Ice Caves and Lava Tubes.** Proposed research, monitoring, and protection of lava tubes and ice caves would help preserve fragile geologic and hydrologic features.

### **Impacts on Soils, Vegetation, and Wildlife**

Impacts from implementation of the minimum requirements alternative would result in similar impacts on vegetation, soils, and wildlife as described under in the preferred alternative except that the monumentwide area of disturbance would be less (see table 14). Under this alternative about 17 acres would be impacted, which is .01 percent of the total monument; however, about half of those 17 acres would be revegetated. Because no new facilities are proposed for East Rendija, McCartys Crater, Braided Cave, the Zuni-Acoma Trail (west end), Las Ventanas, the Narrows, or El Calderon

there would be no new impacts on soils/vegetation/wildlife/wildlife habitat in these areas.

Because the development would be the same under this alternative as under the preferred alternative, impacts at the multiagency center site, Acoma-Zuni Trail (east end), and the roadside kiosk along NM 117 would be the same.

**Bandera Crater/Lava Crater Area.** Impacts would be similar to the preferred alternative except the area of impact would be less, about 6 acres instead of 25.5 acres. Developing the area immediately east of the Candelaria trading post for the visitor center and using the existing access would limit most construction impacts to areas that have been previously disturbed. Impacts to Dripping Lava Cave would be minimal because it would not be developed as a major visitor attraction.

**Sandstone Bluffs Overlook.** The existing Sandstone Bluffs access road would not be paved under this alternative. Minor realignment of an existing sharp curve would result in less than 1 acre of disturbance to grass/shrubland vegetation.

### **Impacts on Threatened and Endangered Species**

No known adverse effects on federal or state endangered or threatened species would occur from implementation of this alternative.

### **Impacts on Water Resources**

impacts on water resources would be the same as for the preferred alternative.

### **Impacts on Floodplains and Wetlands**

No facilities or visitor use areas are proposed in floodplain or wetland areas; therefore there would be no impacts.

### **Impacts on Air Quality**

Impacts on air quality would be the same **as** for the preferred alternative; however, the lower scale of development would result in less air quality degradation.

## Impacts on Visual Quality

The impacts on visual quality under this alternative would be significantly less compared to the preferred alternative because there would be less development—there would be no new development at East Rendija, Braided Cave, Las Ventanas, the Narrows, and McCartys Crater viewpoint. In the Bandera Crater area there would be less development; however, retention of Route 42 on the east side of Cerro Bandera would result in continued sight of vehicles and dust along this segment by visitors on the Bandera Crater trail.

## Impacts on Audio Quality (Natural Quietness)

With less development proposed than under the preferred alternative, short-term, construction-related noise would be significantly less. As under the preferred alternative, increased visitor use in developed areas would result in more noise.

## IMPACTS ON THE CULTURAL ENVIRONMENT

Because implementation of the plan for cultural resource management is the same under the minimum requirements alternative, the impacts would be the same as under the preferred alternative.

### General Impacts from Development and Visitor Use on the Cultural Environment

General impacts of development and visitor use on cultural resources presented in the preferred alternative are also applicable to this alternative for the sites with the same proposed development: they will not be repeated here. The one exception would be less staff and therefore less deterrent to illegal looting and vandalism. Because the minimum requirements alternative proposes less development, there would be fewer overall impacts, primary and secondary, on cultural resources.

### Site-Specific Impacts on the Cultural Environment

**Multiagency Center.** Impacts would be the same as under the preferred alternative.

**Bandera Crater/Lava Crater Area.** Construction of the new visitor center immediately east of the existing trading post complex would disturb about the same acreage as under the preferred alternative. Construction of the maintenance and housing facilities would occur on the same site for both alternatives, and the impacts would be the same. Construction might affect unknown subsurface archeological resources at the visitor center and residential area sites by disturbing and compacting soils, damaging artifacts, and irreversibly altering the context of buried archeological remains,

In this alternative, new roads and trails would be fewer in number and in length than under the preferred alternative, disturbing about 3 acres less terrain, and there would be fewer impacts. Total ground disturbance for all developments at the Bandera Crater area is estimated at 6 acres. All cultural resources investigations, evaluations, and mitigations, including consultations with the State Historic Preservation Office and American Indians (as described previously) would precede comprehensive design so that construction would avoid sites. This would include secondary impact areas.

Although they would not be removed under this alternative, the abandoned sawmill site, dumps, and ruins of cabins in the Bandera area would be investigated and documented prior to increased visitor activity.

Old trails and ways as well as recorded and unrecorded archeological sites might be impacted by continued visitor use in the area. These impacts would be assessed by surveys, mapping, and evaluation of the sites.

Treatment and adaptive use of the historic trading post complex in the vicinity of Bandera Crater would be the same as under the preferred alternative with the exception that no cabins would be adapted for use as restrooms. Careful site design, section 106 compliance, and consultation with American Indians would be the same as under the preferred alternative. However, because the new visitor center would be closer to the historic structures at the trading post, special attention to site and building designs would be needed. Despite such mitigations, the large volume of use, including increased parking area capacity for both the visitor center and the trading post/crater/Ice Cave area

would tend to concentrate more visitors close to the trailhead and could affect the historic ambience in the area.

**Zuni-Acoma/Acoma-Zuni Trail.** There would be no new impacts to the Zuni-Acoma Trail (west end) under this alternative. Impacts and mitigating measures for the Acoma-Zuni Trail (east end) would be the same as under the preferred alternative.

**Las Ventanas/Sandstone Bluffs.** Under this alternative, no new impacts are expected, except that the access road would be closed at night to help protect sites and ensure privacy for American Indian religious activities. Consultation with American Indians would continue in order to protect sites from visitor impacts.

Las Ventanas is on the National Register of Historic Places, and measures for protecting and managing this area would be included in discussions with the State Historic Preservation Office.

**Roadside Kiosk Along NM 117.** Impacts would be the same as under the preferred alternative.

### **Impacts on Museum Collection**

The monument's museum collection, including new storage space, would be managed and protected in the same way as described in the preferred alternative; therefore the impacts would be the same.

### **IMPACTS ON AMERICAN INDIANS**

The impacts on American Indians would be the same as under the preferred alternative.

### **IMPACTS ON VISITORS**

This alternative (like the preferred) would provide a multiagency center and a Bandera Crater visitor center. The impacts on visitors at these two centers would be the same as under the preferred alternative.

Under the minimum requirements alternative, the Bandera Crater area (including only the Ice Cave, Bandera Crater, and a surface features trail) and

Sandstone Bluffs overlook would be the only two major improved and interpreted sites available, and most visitors would have little chance for solitude because of the concentration of visitors at these two areas. Access to Dripping Lava Cave, the East Rendija area, the El Calderon area, and the Narrows would be possible by existing roads (high-clearance vehicles only) or primitive trails. The Corral road would remain open and the El Calderon road that accesses the national conservation area south of the monument boundary would not be improved, i.e., access would continue to be by the existing roads, which are often muddy in the winter. Las Ventanas, one of the monument's most significant cultural sites and an important primary visitor opportunity under the preferred alternative would not be accessible to the general public. Overall, under this alternative access would be provided to fewer resources. The hiker who is willing to commit time would have numerous opportunities to explore the diverse resources of El Malpais. However, most visitors would have far less exposure to the resources necessary to complement the visitor center presentations in conveying the primary interpretive themes of the monument.

Compared to the preferred alternative, the visitor experience in the Bandera area would be far more directly oriented to the Ice Cave and Bandera Crater, and the visitor would enter quickly from NM 53 and almost immediately be at the main resource, with no time to approach the trading post area over a special road that allows for leisurely viewing of the volcanic terrain in the area. Also, fewer trails would be available; visitors wishing to see Dripping Lava Cave would be required to hike over a long primitive trail.

The preservation of Route 42 along its existing alignment would result in no new impacts; the minimal sight distance for motorists turning onto NM 53 from Route 42 would continue.

### **IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT**

Implementation of this alternative would result in socioeconomic impacts that are similar to those described under the preferred alternative. The minimum requirements alternative would require a staff increase of only 3.7 FTEs (6.6 less than under the preferred). Thus, expenditures in the local

communities by monument employees would be proportionately less.

The minimum requirements alternative also proposes a somewhat lower level of visitor facilities as compared to the preferred alternative. This might result in fewer recreationists being attracted to the monument or in visitors staying for shorter periods of time. The effect would be a proportional decrease in the magnitude of economic benefits received from tourism expenditures.

## SUMMARY OF IMPACTS

The following table presents a summary comparison of the impacts of the two alternatives.

**TABLE 15: SUMMARY COMPARISON OF IMPACTS**

<b>Preferred Alternative</b>	<b>Minimum Requirements Alternative</b>
<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>	<b>GENERAL IMPACTS ON NATURAL RESOURCES</b>
Various studies and monitoring programs would provide information for more efficient management of the monument's natural resources.	Same as preferred
Detailed action plans would enable managers to perpetuate the fauna and flora as part of a total ecosystem; baseline data would help managers identify future changes and avoid adverse impacts to monument resources.	Same as preferred
More staff would be available for patrols and resource protection.	Less staff available and less protection than under preferred.
<b>Impacts on Geological Resources</b>	<b>Impacts on Geological Resources</b>
Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 4,750 cubic yards of bedrock covering 13 acres.	Constructing buildings, utilities, and roads would be an irretrievable loss of approximately 1,300 cubic yards of bedrock covering 2.1 acres.
<b>impacts on Soils/Vegetation/Wildlife</b>	<b>impacts on Soils/Vegetation/Wildlife</b>
Removal of 63 acres of soils/vegetation and wildlife habitat would affect only .05 percent of the monument. About 30 acres would be restored to natural conditions. Disturbed areas would be susceptible to invasion of exotic species. Wildlife impacts would be localized and temporary, with no significant long-term effects. With closure of Bat Cave to visitors, bat habitat would be better protected.	Impacts would be similar to the preferred, but less in degree and in fewer areas. Removal of 17 acres of soils/vegetation would affect only .01 percent of the monument. About 8 acres would be restored.
Careful site design and revegetation would minimize impacts on soils, vegetation, and wildlife.	Same as preferred
Reclamation of cinder pits and vehicular ways would reduce erosion and restore native vegetation.	Same as preferred
<b>Impacts on Threatened and Endangered Species</b>	<b>impacts on Threatened and Endangered Species</b>
No impacts on known federal or state endangered or threatened species.	Same as preferred

### **Impacts on Water Resources**

Temporary impacts on surface water quality during construction and minor impacts of groundwater because of long-term consumption.

### **Impacts on Floodplains and Wetlands**

No impacts.

### **Impacts on Air Quality**

No impact on overall air quality; short-term dust and fumes during construction. Monitoring air quality would provide the information necessary to maintain the monument's class II air quality.

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design). Overall improvement because of the closure and revegetation of the cinder pits and vehicular ways.

Realignment of northern part of Route 42 would eliminate visual impacts of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Minor short-term noise from facility construction.

### **IMPACTS ON CULTURAL RESOURCES**

Construction potentially affecting unknown archeological resources, to be mitigated by surveys, site avoidance, etc. Overall, development would have few impacts. Impacts of use to be mitigated by careful design, site monitoring, public education, and law enforcement. More staff would help deter looting and protect resources.

Consultation with American Indians would improve decisions about development, resource protection, interpretation, and use. Effective communication between the Park Service and American Indians would help resolve conflicts, establish trust, and perhaps create new methods of NPS management. Temporary closure of some areas would ensure American Indian religious privacy. Access ensured for subsistence activities.

Collections would be stored consistent with NPS policies, secure from theft, fire, and other adverse environmental conditions.

Sites vulnerable to looting, vandalism, and ordinary visitor activities would be identified and prioritized for protection.

Interpretation of cultural landscape concept would elicit visitor assistance in resource protection.

### **Impacts on Water Resources**

Same as preferred

### **Impacts on Floodplains and Wetlands**

Same as preferred

### **impacts on Air Quality**

Same as preferred

### **Impacts on Visual Quality**

Minor impact because of facilities (mitigated by careful design), but less than under preferred. Overall improvement because of the closure and revegetation of cinder pits and vehicular ways.

No realignment of Route 42; continued visual impact of vehicles from **Bandera Crater** trail.

### **Impacts on Audio Quality**

Same as preferred, although less because of less development.

### **IMPACTS ON CULTURAL RESOURCES**

Same as preferred except less potential for disturbance to archeological resources. Less staff available and less protection available than under preferred.

Same as preferred

Same as preferred

Same as preferred

Same as preferred

Adaptive use of trading post complex would support long-term preservation of this historic resource.

Same as preferred

Option 1: Minor impacts at Las Ventanas site. Consultation with Acoma, surveys, careful design, and patrols would minimize impact. Consultation with the State Historic Preservation Office would also take place.

No impact

Option 2: Removal of backfill from the tower kiva at Las Ventanas could diminish its integrity and significance, would be costly, and would contribute to deterioration of structural elements and artifacts. Mitigation would include consultation with Acoma and the state of New Mexico and implementation of historic preservation studies and procedures.

No impact

Eventual survey and evaluation of the total monument resource would enable managers to formulate the most practicable protection strategies.

Same as preferred

### IMPACTS ON AMERICAN INDIANS

### IMPACTS ON AMERICAN INDIANS

Visitors might unintentionally intrude on American Indian traditional activities, trespass on Indian lands, or disturb significant cultural sites. Mitigation could include monitoring, closure, education/information programs, and consultation with concerned groups.

Same as preferred

Resource management plans could affect resources traditionally used by Indians. Traditional use studies and consultation would help guide resource management. Construction projects could disturb religious activities and sites. Consultation and measures to protect sites and religious privacy would occur prior to construction.

### IMPACTS ON VISITORS

### IMPACTS ON VISITORS

High quality orientation, information, and interpretation would provide the public a safe and enjoyable visit and ensure an understanding of the monument's significance. Two visitor centers to initiate the visitor experience and nine developed areas with trails, overlooks, and waysides covering many features and themes would be available.

Same as preferred, except only two developed areas with structured activities would be available. Most visitors would be denied access to the highly significant Las Ventanas site.

Would disperse use in several areas and give visitors opportunities for both structured experiences and solitude.

Most visitor use would concentrate at **Bandera** Crater and Sandstone Bluffs where there would be more crowding and less opportunity for solitude.

Safer built environment for visitors at several sites.

Same as preferred, but fewer sites.

Primitive campground for longer-term visitors who want to explore the backcountry.

No campground available.

Route 42 improvement would make access to East Rendija safer and more reliable. Passenger cars would be able to reach East Rendija.

Continued unreliable access for motorists on Route 42, depending on fair weather. Only high-clearance vehicles could reach East Rendija.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Increasing expenditures by monument visitors in local communities.

10.3 additional full-time-equivalent employees plus families would increase expenditures in the local communities.

Some NPS employees hired from the local area if qualified.

New private sector jobs would result.

Financial gains to local companies from possible construction awards or from local expenditures by other contractors. These would be short-term benefits.

Local expenditure for leased office space in Grants.

About 54 additional acres north of multiagency center site would not be available for commercial development.

## IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

Same as preferred, however fewer visitors and less economic benefit to communities from tourist expenditures.

Only 3.7 additional full-time-equivalent employees plus families would benefit local economy.

Fewer NPS employees hired.

Fewer private sector jobs would result.

Same as preferred, but fewer contracts and expenditures.

Same as preferred

Same as preferred

# WILDERNESS SUITABILITY STUDY

## INTRODUCTION

The purpose of wilderness designation, which is accomplished solely by congressional action, is to preserve and protect wilderness characteristics and values over the long term while providing opportunities for solitude and unconfined recreation. With passage of the 1964 Wilderness Act (16 USC 1131 et seq.), Congress declared that it is national policy to secure for present and future generations the benefits of enduring wilderness resources.

Section 501 .(c) of the El Malpais legislation states that, "The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all roadless lands within the boundaries of the monument." The purpose of this study, then, is to evaluate and identify monument lands that possess wilderness characteristics as defined in the Wilderness Act and NPS *Management Policies*.

## WILDERNESS DEFINITION

The Wilderness Act describes and defines a wilderness area as follows:

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in the Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive

and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

## CRITERIA FOR WILDERNESS

Chapter 6 of the NPS *Management Policies*, "Wilderness Preservation and Management," states that wilderness includes

lands and waters found to possess the characteristics and values of wilderness, as defined in the Wilderness Act

lands that have been logged, farmed, grazed, or otherwise utilized in ways not involving extensive development or alteration of the landscape. (These lands will be considered for wilderness if at the time of study the effects of these activities are substantially unnoticeable or their wilderness character could be restored through appropriate management actions.)

The policies continue to say that lands will not be excluded from wilderness because of the following:

Management practices require the use of tools, equipment, or structures if those practices are necessary for the health and safety of wilderness travelers or protection of the wilderness area.

The lands contain prior rights or privileges, such as livestock grazing and stock driveways, provided these operations do not involve the routine use of motorized or mechanical equipment and do not involve development and structures to such an extent that the human imprint is substantially noticeable.

An area possesses mineral rights and may be subject to exploration and development if it is likely that the mineral rights will be

relinquished, acquired, exchanged, or otherwise eliminated in the foreseeable future.<sup>46</sup>

The lands contain underground utility lines if these lines do not require the routine use of mechanized and motorized equipment. (Areas containing aboveground utility lines do not meet wilderness criteria.)

There are historic features in an area that attract visitors primarily for the enjoyment of solitude and unconfined recreation. (An area will not qualify if it contains historic features that are considered primary visitor attractions.)

Section 501 (c) of the “El Malpais Senate Report,” July 6, 1987, provides further guidance. The report states that

It is the intention of the Committee that the National Park Service apply the same criteria for determining which lands are ‘roadless’ as would be applied by the BLM; that is, the definition of ‘road’ found in the BLM’s wilderness inventory policy should be used.

The Bureau of Land Management defines a “road” as “a vehicle route which has been improved and maintained by mechanical means to ensure relatively regular and continuous use.” The BLM definition of a “way” is “a vehicle route which has not been improved and maintained by mechanical means to ensure relatively regular and continuous use.” Therefore, areas of the monument containing vehicular “ways” as defined by the Bureau of Land Management are considered “roadless” by the intent of the Senate report.

The monument contains several vehicular routes that clearly meet the definition of a “way,” which classifies these areas as “roadless.” The ways were created to provide backcountry access for early timber and livestock grazing operations. These routes are a significant resource problem (see “The Plan for Natural Resource and Wildlife

Management” section), resulting in compacted soil and erosion problems. The ways serve no particular purpose except to provide infrequently used routes for backcountry visitors. Some are nonroutinely used by ranchers for maintaining livestock grazing operations. As previously stated, this commercial grazing, which is authorized by Congress, will be discontinued after December 31, 1997.

## INTERIM MANAGEMENT OF SUITABLE LANDS

All lands determined suitable for wilderness designation will be managed under the provisions of the Wilderness Act and NPS policies to maintain wilderness characteristics and values. Interim wilderness management will continue until designation by Congress.

Section 501 .(c) (2) of the El Malpais establishing legislation states

Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary [of the Interior], through the Director of the National Park Service, shall manage all roadless lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System.

## BRIEF DESCRIPTION OF THE STUDY AREA

Approximately 95 percent of the monument is covered by rugged lava fields, which, along with the limited availability of water, have historically restricted human access and development and limited the exploitation of resources.

In contrast, the more accessible grass/shrubland and forested areas along the lava flow margins have historically been used and contain most of the evidence of historic development. These areas contain national and regional transportation routes

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46. The establishing legislation for the monument provided for BLM exchange of state and privately owned subsurface interests under federally owned lands including the monument. All state subsurface exchanges have been completed. Private exchanges are continuing. Interests yet to be acquired are shown on the Wilderness Suitability map. More detailed information can be found in the El Malpais **Land Protection Plan**.

including US 40, NM 117, NM 53, and Route 42; they have also been heavily grazed and, in the northwestern portion of the monument, heavily timbered. Most visual intrusions in the monument are associated with these activities and include roads and ways, buildings, overhead power and telephone lines, earthen and metal stock tanks, fences, windmills, and corrals.

The monument is bordered on two sides by designated wilderness areas -the 60,000-acre Cebolla Wilderness to the southeast and the 38,210-acre West Malpais Wilderness to the southwest. Additionally, the 17,468-acre Chain of Craters Wilderness Study Area, approximately 2.5 miles west of the monument, is under study for possible wilderness designation. All of these areas are in the national conservation area and are managed by the Bureau of Land Management.<sup>47</sup>

## **WILDERNESS SUITABILITY**

Using the wilderness criteria previously described, an evaluation of the monument was conducted by the Park Service, and approximately 95,811 acres or 83 percent of the monument was found to possess wilderness characteristics and values (see Wilderness Suitability map). The suitable areas include large portions of the major lava flows, including the McCartys, Laguna, and Bandera flows and contain no permanent improvements, have only minor human impacts, and provide outstanding opportunities for solitude and unconfined recreation. They also contain important ecological, geological, archeological, educational, scientific, scenic, or historic resources. Other acreages identified as suitable are the lava fringe areas along the southwestern monument boundary that adjoin the West Malpais Wilderness Area, forming an adjacent NPS/BLM wilderness boundary.

Monument lands that do not possess wilderness qualities and values and have been determined unsuitable for wilderness designation include approximately 19,076 acres or 17 percent of the monument. These areas include the following:

The 1089.70-acre noncontiguous multiagency center site<sup>48</sup> just south of I-40 near Grants – This site does not meet wilderness criteria because of nearby development and small size.

Approximately 152 acres of lands adjacent to roadways – Setbacks in these areas define the wilderness suitability boundary. The setbacks limit visual and audible intrusions while allowing for road improvements and realignments. The setbacks will vary with the type and standard of road, including 300 feet from centerline of paved roads, 100 feet from centerline of high-standard dirt or gravel roads, and 30 feet from centerline of low-standard dirt roads.

The road corridor to Cerro Encierro, which encompasses approximately 17 acres – This road provides administrative and public access to the monument's otherwise inaccessible southwestern Laguna lava flow. The road is necessary for fire, search-and-rescue, and resource management operations. It also provides a primitive vehicular recreational opportunity unavailable elsewhere in the monument.

Approximately 17,815 acres of the lava fringe areas – These areas include proposed development sites such as East Rendija, El Calderon, Sandstone Bluffs, Las Ventanas, the Zuni-Acoma/Acoma-Zuni trailheads, the Narrows, and McCartys Crater viewpoint. This acreage also contains most of the roads that provide motorized access for monument protection and management, American Indian subsistence and religious purposes, and ranching operations (to be discontinued by 1998).

## **POTENTIAL WILDERNESS ADDITIONS**

Potential wilderness lands are those areas surrounded by or adjacent to wilderness that meet the criteria and would be suitable for wilderness

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47. For a detailed description of monument resources see the "Affected Environment" section of this document.

48. With the proposed boundary adjustment, this figure would be approximately 484 acres.

designation if in federal ownership. However, because these lands are not currently in federal ownership and because federal acquisition of these private lands may or may not become a reality, these lands are identified as potential wilderness additions for the purposes of this study only. The Park Service will try to work cooperatively with these landowners to protect the wilderness qualities of their lands. Within the boundaries of El Malpais National Monument there are approximately 18,079.53 acres of private lands, 10,925 acres of which are potential wilderness additions (see Wilderness Suitability map).

### IMPLICATIONS OF MANAGING LANDS IDENTIFIED AS SUITABLE FOR WILDERNESS<sup>49</sup>

As previously described, all lands that have been found suitable for wilderness designation will be managed as wilderness until such time as Congress specifically designates wilderness at El Malpais National Monument. This entails the closure of all ways and ensures no use of motorized or mechanical equipment, including mountain bikes, motorcycles, and chain saws (by both visitors and monument staff). Travel will be by foot, horseback, or pack animal only. Caves with entrances in wilderness-suitable land will be managed as wilderness. Also, development within suitable wilderness will be limited to the those facilities determined necessary to carry out the objectives as defined in the Wilderness Act and NPS **Management Policies**. The construction of facilities incompatible with wilderness values or management objectives will be prohibited. (The existing intrusive and incompatible livestock ranching developments will be removed following discontinuation of grazing on December 31, 1997, provided that none of the structures are determined historic.)

Travel within the areas suitable for wilderness will be more difficult and require greater planning and effort. Elimination of routine mechanized and motorized usage will not be an inconvenience to livestock operators because existing ranching operations do not require routine mechanized or

motorized use within areas determined to be suitable for wilderness.

The establishing legislation states that traditional American Indian practices may continue in El Malpais, consistent with the Wilderness Act. The Wilderness Act excludes use of motorized vehicles and equipment in wilderness areas, and nonexclusive access will be by foot, horseback, or other types of pack animals. Certain locations within the areas suitable for wilderness may be periodically closed to the general public for short periods for American Indian purposes. (Coordination with the superintendent will be necessary to arrange such closures.) Otherwise, there are no important differences in the ways American Indians may use lands suitable for wilderness in the national monument. It should be noted that, with few exceptions, most of the area suitable for wilderness has no roads, so designation as wilderness-suitable lands should not change traditional use patterns.

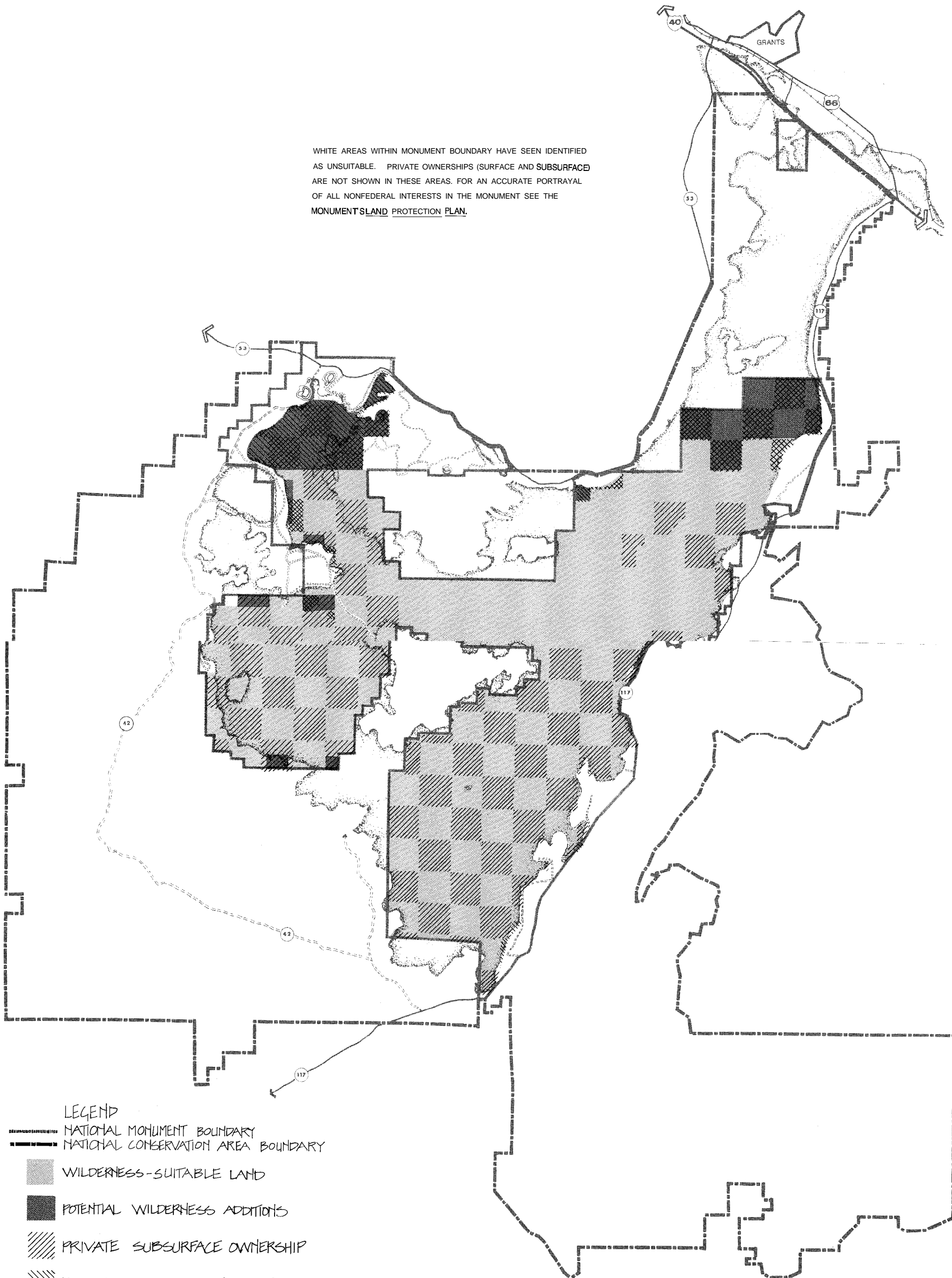
Research scientists who were required to camp in wilderness-suitable areas for prolonged periods would be required to accept primitive camping conditions and use of minimum equipment. Scientists wanting to inventory and conduct other research activities, including those associated with archeology, would be restricted in their scope of work. This would include the requirements that their projects would be allowed only if there is no other alternative to their research in wilderness-suitable areas and their projects would not interfere with other uses except for short duration. Electronic monitoring devices to protect cultural resources would be allowed only if determined to be the minimum necessary tool.

The Park Service would provide public information and interpretation about wilderness values, fostering an appreciation of these values. Visitors would be required to accept the land largely on its own terms, accepting certain risks that are inherent to primitive recreation (including potential danger from adverse weather and extremely rugged terrain). NPS interpretation and safety information would partly mitigate these hazards.

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49. Management zoning, described earlier, restricts many of the same activities and uses that the designation as wilderness suitable restricts (see appendix C).

WHITE AREAS WITHIN MONUMENT BOUNDARY HAVE BEEN IDENTIFIED AS UNSUITABLE. PRIVATE OWNERSHIPS (SURFACE AND SUBSURFACE) ARE NOT SHOWN IN THESE AREAS. FOR AN ACCURATE PORTRAYAL OF ALL NONFEDERAL INTERESTS IN THE MONUMENT SEE THE MONUMENT'S LAND PROTECTION PLAN.



## WILDERNESS SUITABILITY

EL MALPAIS NATIONAL MONUMENT

U.S. DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

DSC/DEC 1989/103/20,020 A

As described in the natural resource and wildlife management section, a wilderness management plan will be developed by the superintendent to guide the preservation, management, and use of the area. The plan will be developed with public involvement and will contain specific, measurable wilderness management objectives for the preservation of wilderness values as specified in the Wilderness Act and NPS Management *Policies*.

There may be a slight increase in visitors seeking wilderness recreation experiences; however, this increase will not significantly benefit the local economy or add to the region's recreation opportunities.

Wilderness designation, and in this case determination of lands suitable for wilderness, will help ensure long-term perpetuation of wilderness resources and values while providing opportunities for solitude and unconfined recreation. The elimination of vehicles will allow for restoration/ reclamation of disturbed areas, enhance wilderness values, and increase the opportunity for solitude. For those who choose to hike or journey by horseback, opportunities for unconfined recreation will be greatly enhanced.

## CONCLUSION

Most of El Malpais National Monument lands have been found to possess wilderness characteristics and values. This amounts to 95,811 acres or 83 percent of the monument. This total includes potential wilderness additions (wilderness-suitable nonfederal lands as described above).

Based on the analysis of the suitability criteria, the following four categories of land in El Malpais National Monument have been identified with respect to wilderness suitability (see Wilderness Suitability map):

Suitable federal lands	approximately 84,886 acres
Potential wilderness addition& (suitable nonfederal lands)	approximately 10,925 acres
<b>Total suitable lands</b>	<b>95,811 acres</b>
Unsuitable federal lands	approximately 11,575 acres
Unsuitable nonfederal lands	approximately 7,536 acres
<b>Total unsuitable lands</b>	<b>19,111 acres</b>
<b>Total monument land</b>	<b>114.922 acres</b>

## **Federal**

Advisory Council on Historic Preservation  
Bureau of Land Management, Rio Puerco  
and Santa Fe Offices  
U.S. Fish and Wildlife Service, Albuquerque  
U.S. Forest Service  
Southwest Regional Office  
Cibola National Forest  
Apache National Forest

## **State**

Albuquerque Convention and Visitors Bureau  
Albuquerque Department of Economic Development  
New Mexico Department of Game and Fish,  
Santa Fe Office  
New Mexico Economic Development  
and Tourism Department  
New Mexico Energy, Mineral, and Natural  
Resources Department  
New Mexico Energy, Mineral, and Natural  
Resources Department, Parks  
and Recreation Division  
New Mexico State Highway and Transportation  
Department  
New Mexico State Historic Preservation Office  
New Mexico State Tourism Office  
University of New Mexico, Bureau of Business  
and Economic Research

## **County**

Cibola Convention and Visitor Bureau

## **City**

City of Grants  
Gallup Chamber of Commerce  
Greater Grants Chamber of Commerce

## **Indian Tribes**

Pueblo of Acoma  
Pueblo of Laguna  
**Ramah** Navajo Chapter  
Pueblo of Zuni

## APPENDIX A: ESTABLISHING LEGISLATION

PUBLIC LAW 100-225—DEC. 31, 1987

101 STAT. 1539

Public Law 100-225  
100th Congress

### An Act

To establish the El Malpais National Monument and the El Malpais National Conservation Area in the State of New Mexico, to authorize the Masau Trail, and for other purposes.

Dec. 31, 1987  
[H.R. 403]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

#### TITLE I—EL MALPAIS NATIONAL MONUMENT

##### ESTABLISHMENT OF MONUMENT

**SEC. 101. (a)** In order to preserve, for the benefit and enjoyment of present and future generations, that area in western New Mexico containing the nationally significant Grants Lava Flow, the Las Ventanas Chacoan Archeological Site, and other significant natural and cultural resources, there is hereby established the El Malpais National Monument (hereinafter referred to as the “monument”). The monument shall consist of approximately 114,000 acres as generally depicted on the map entitled “El Malpais National Monument and National Conservation Area” numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for public inspection in the offices of the Director of the National Park Service, Department of the Interior. **16 USC 460uu.**

Public  
information.

**(b)** As soon as practicable after the enactment of this Act, the Secretary of the Interior (hereinafter referred to as the “Secretary”) shall file a legal description of the monument with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description and in the map referred to in subsection **(a)**. The legal description shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior.

Public  
information.

##### TRANSFER

**SEC. 102.** Lands and waters and interests therein within the boundaries of the monument, which as of the day prior to the date of enactment of this Act were administered by the Forest Service, United States Department of Agriculture, are hereby transferred to the administrative jurisdiction of the Secretary to be managed as part of the monument in accordance with this Act. The boundaries of the Cibola National Forest shall be adjusted accordingly. **National Forest System. 16 USC 460uu-1.**

##### MANAGEMENT

**SEC. 103.** The Secretary, acting through the Director of the National Park Service, shall manage the monument in accordance with **16 USC 460uu-2.**

101 STAT.1539

the provisions of this Act, the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1 et seq.), and other provisions of law applicable to units of the National Park System. The Secretary shall protect, manage, and administer the monument for the purposes of preserving the scenery and the natural, historic, and cultural resources of the monument and providing for the public understanding and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

#### PERMITS

Animals.  
Contracts.  
16 USC 460uu-3.

SEC. 104. Where any lands included within the boundary of the monument on the map referred to in subsection 101(a) are legally occupied or utilized on the date of enactment of this Act for grazing purposes, pursuant to a lease, permit, or license which is-

(a) for a fixed term of years issued or authorized by any department, establishment, or agency of the United States, and

(b) scheduled for termination before December 31, 1997,

the Secretary, notwithstanding any other provision of law, shall allow the persons holding such grazing privileges (or their heirs) to retain such grazing privileges until December 31, 1997, subject to such limitations, conditions, or regulations as the Secretary may prescribe to insure proper range management. No grazing shall be permitted on lands within the boundaries of the monument on or after January 1, 1998.

State and local  
governments.  
Indians.

#### TITLE II-MASAU TRAIL

##### DESIGNATION OF TRAIL

Arizona.  
Federal  
Register.  
publication.  
16 USC  
460uu-11.

SEC. 201. In order to provide for public appreciation, education, understanding, and enjoyment of certain nationally significant sites of antiquity in New Mexico and eastern Arizona which are accessible by public road, the Secretary, acting through the Director of the National Park Service, with the concurrence of the agency having jurisdiction over such roads, is authorized to designate, by publication of a description thereof in the Federal Register, a vehicular tour route along existing public roads linking prehistoric and historic cultural sites in New Mexico and eastern Arizona. Such a route shall be known as the **Masau** Trail (hereinafter referred to as the "trail").

##### AREAS INCLUDED

16 USC  
460uu-12.

SEC. 202. The trail shall include public roads linking El Malpais National Monument as established pursuant to title I of this Act, El Morro National Monument, **Chaco** Cultural National Historical Park, Aztec Ruins National Monument, Canyon De Chelly National Monument, **Pecos** National Monument, and **Gila** Cliff Dwellings National Monument. The Secretary may, in the manner set forth in section 201, designate additional segments of the trail from time to time as appropriate to link the foregoing sites with other cultural sites or sites of national significance when such sites are designated and protected by Federal, State, or local governments, Indian tribes, or nonprofit entities.

## INFORMATION AND INTERPRETATION

SEC. 203. With respect to sites linked by segments of the trail which are administered by other Federal, State, local, tribal, or nonprofit entities, the Secretary may, pursuant to cooperative agreements with such entities, provide technical assistance in the development of interpretive devices and materials in order to contribute to public appreciation of the natural and cultural resources of the sites along the trail. The Secretary, in cooperation with State and local governments, Indian tribes, and nonprofit entities, shall prepare and distribute informational material for the public appreciation of sites along the trail. **16 USC 460uu-13.**

## MARKERS

SEC. 204. The trail shall be marked with appropriate markers to guide the public. With the concurrence and assistance of the State or local entity having jurisdiction over the roads designated as part of the trail, the Secretary may erect thereon and maintain signs and other informational devices displaying the Masau Trail Marker. The Secretary is authorized to accept the donation of suitable signs and other informational devices for placement at appropriate locations. **16 USC 460uu-14.**

## TITLE III—EL MALPAIS NATIONAL CONSERVATION AREA

## ESTABLISHMENT OF AREA

SEC. 301. (a) In order to protect for the benefit and enjoyment of future generations that area in western New Mexico containing the La **Ventana** Natural Arch and the other unique and nationally important geological, archeological, ecological, cultural, scenic, scientific, and wilderness resources of the public lands surrounding the Grants Lava **Flows**, there is hereby established the El Malpais National **Conservation** Area (hereinafter referred to as the "conservation area"). The conservation area shall consist of approximately 262,690 acres of federally owned land as generally depicted on a map entitled "El **Malpais** National Monument and National Conservation Area" numbered **NM-ELMA-80,001-B** and dated May 1987. The map shall be on file and available for inspection in the offices of the Director of the Bureau of Land Management of the Department of the Interior. **16 USC 460uu-21.**

(b) As soon as practicable after the date of enactment of this Act, the Secretary shall file a **legal** description of the conservation area designated under this section with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular **Affairs** of the United States House of Representatives. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The **legal** description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior. **Public information.**

## MANAGEMENT

SEC. 302. (a) The Secretary, acting through the Director of the Bureau of Land Management, shall manage the conservation area to protect the resources specified in section 301 and in accordance with this Act. the Federal Land Management and Policy Act of 1976 **Animals. 16 USC 460uu-22.**

and other applicable provisions of law, including those **provisions** relating to grazing on public lands.

(b) The Secretary shall permit hunting and trapping within the conservation **area** in accordance with applicable laws and **regulations** of the United States and the State of New Mexico; except that the Secretary, after consultation with the New Mexico Department of Game and Fish, may issue regulations designating zones where and establishing periods when no hunting or trapping shall be permitted for reasons of public safety, administration, or public use and enjoyment.

Forests and  
forest  
products.

(c) Collection of green or dead wood for sale or other commercial **purposes** shall not be permitted in the conservation area.

(d) Except as otherwise provided in section **402(b)**, within the conservation area the grazing of livestock shall be permitted to **continue**, pursuant to applicable Federal **law**, including this Act, and subject to such reasonable regulations, policies, and practices as the Secretary deems necessary.

National  
Wilderness  
Preservation  
System.

#### TITLE IV-WILDERNESS

##### DESIGNATION OF WILDERNESS

16 USC  
460uu-31.

SEC. 401. (a) In furtherance of the purposes of the Wilderness Act (78 Stat. 890; 16 U.S.C. 1311, there are hereby designated as wilderness, and, therefore, as components of the National Wilderness Preservation System, the **Cebolla** Wilderness of approximately 60,000 acres, and the West Malpais Wilderness of approximately 38,210 acres, as each is generally depicted on the map entitled "El **Malpais** National Monument and National Conservation Area" numbered NM-ELMA-80,001-B and dated May 1987. The map shall be on **file** and available for inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

16 USC 1132  
note.

Public  
information.

(b) As soon as practicable after the date of the enactment of this Act, the Secretary shall file a legal description of each wilderness area designated by this Act with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be **on** file and available for public inspection in the **offices** of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

##### MANAGEMENT

16 USC  
460uu-32.

SEC. 402. (a) Subject to valid existing rights, each wilderness area designated under this Act shall be administered by the Secretary, through the Director of the Bureau of Land Management, in accordance with the provisions of the Wilderness Act governing areas designated by that Act as wilderness, except that any reference in **such** provisions to the effective date of the Wilderness Act shall be deemed to be **a** reference to the date of enactment of this Act.

Animals.

(b) Within the wilderness areas designated by this Act, the grazing of livestock, where established prior to the enactment of this Act, shall be **permitted** to continue subject to such reasonable regulations, **policies**, and practices as the Secretary deems necessary, as

long as such regulations, policies, and practices fully conform with and implement the intent of Congress regarding grazing in such areas as such intent is expressed in the Wilderness Act and section 108 of Public Law 96-560 (16 U.S.C. 1133 note).

## TITLE V-GENERAL PROVISIONS

### MANAGEMENT PLANS

**SEC. 501. (a)** Within three full **fiscal** years following the **fiscal** year of enactment of this Act, the Secretary shall develop and transmit to the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural Resources of the United States Senate, separate general management plans for the monument and the conservation area which shall describe the appropriate uses and development of the monument and the conservation area consistent with the purposes of this Act. The plans shall include but not be limited to each of the following:

National  
Wilderness  
Preservation  
System.  
16 USC  
460uu-41.

(1) implementation plans for a continuing program of interpretation and public education about the resources and values of the monument and the conservation area;

(2) proposals for public facilities to be developed for the conservation area or the monument, including a visitors center in the vicinity of **Bandera** Crater and a multiagency orientation center, to be located in or near Grants, New Mexico, and adjacent to Interstate 40, to accommodate visitors to western New Mexico;

(3) natural and cultural resources management plans for the monument and the conservation area, with a particular emphasis on the preservation and long-term **scientific** use of archaeological resources, giving high priority to the enforcement of the provisions of the Archeological Resources Protection Act of 1979 and the National Historic Preservation Act within the monument and the conservation area. The natural and **cultural** resources management plans **shall** be prepared in close consultation with the Advisory **Council** on Historic Preservation, the New Mexico State Historic Preservation **Office**, and the **local** Indian people and their traditional cultural and religious authorities; and such plans **shall** provide for long-term scientific use of archaeological resources in the monument and the conservation area, including the wilderness areas designated by this Act; and

Indians.

(4) wildlife resources management plans for the monument and the conservation area prepared in close consultation with appropriate departments of the State of New Mexico and using previous studies of the area.

Wildlife.

**(b)(1)** The general management plan for the conservation area shall review and recommend the suitability or nonsuitability for preservation as wilderness of those lands comprising approximately 17,468 acres, identified as "Wilderness Study Area" (hereafter in this title referred to as the "**WSA**") on the map referenced in section 101.

**(2)** Pending submission of a recommendation and until otherwise directed by an Act of Congress, the Secretary, acting through the Director of the Bureau of Land Management, **shall** manage the

lands within the WSA so as to maintain their potential for inclusion within the National Wilderness Preservation System.

(c)(1). The general management plan for the monument shall review and recommend the suitability or nonsuitability for preservation as wilderness of all **roadless** lands within the boundaries of the monument as established by this Act except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

(2) Pending the submission of a recommendation and until otherwise directed by Act of Congress, the Secretary, through the Director of the National Park Service, shall manage all **roadless** lands within the boundaries of the monument so as to maintain their potential for inclusion in the National Wilderness Preservation System, except those lands within the areas identified as “potential development areas” on the map referenced in section 101.

#### ACQUISITIONS

Public lands.  
Gifts and  
property.  
16 USC  
460uu-42.

**SEC. 502.** Within the monument and the conservation area, the Secretary is authorized to acquire lands and interests in lands by donation, purchase with donated or appropriated funds, exchange, or transfer from any other Federal agency, except that such lands or interests therein owned by the State of New Mexico or a political subdivision thereof may be acquired only by exchange. It is the sense of Congress that the Secretary is to complete the acquisition of non-Federal subsurface interests underlying the monument and the conservation area no later than three full fiscal years after the fiscal year of enactment of this Act.

#### STATE EXCHANGES

Public lands.  
Gifts and  
property.  
16 USC  
460uu-43.

**SEC. 503. (a)** Upon the request of the State of New Mexico (hereinafter referred to as the “State”) and pursuant to the provisions of this section, the Secretary shall exchange public lands or interests in lands elsewhere in the State of New Mexico, of approximately equal value and selected by the State, acting through its Commissioner of Public Lands, for any lands or interests therein owned by the State (hereinafter referred to as “State lands”) located within the boundaries of the monument or the conservation area which the State wishes to exchange with the United States.

**(b)** Within six months after the date of enactment of this Act, the Secretary **shall** notify the New Mexico Commissioner of Public Lands what State lands are within the monument or the conservation area. The notice shall contain a listing of all public lands or interest therein within the boundaries of the State of New Mexico which have not been withdrawn from entry and which the Secretary, pursuant to the provisions of sections 202 and 206 of the Federal Land Policy and Management Act of 1976, has identified as appropriate for transfer to the State in exchange for State lands. Such listing shall be updated at least annually. If the New Mexico Commissioner of Public Lands gives notice to the Secretary of the State’s desire to obtain public lands so listed, the Secretary shall **notify** the Commissioner in writing as to whether the Department of the **Interior** considers the State lands within the monument or conservation area to be of approximately equal value to the listed lands **or** interests in lands the Commissioner has indicated the State desires to obtain. It is the sense of the Congress that the exchange **of**

lands and interests therein with the State pursuant to this section should be completed within two years after the date of enactment of this Act.

#### MINERAL EXCHANGES

**SEC. 504. (a)** The Secretary is authorized and directed to exchange the Federal mineral interests in the lands described in subsection (b) for the private mineral interests in the lands described in subsection (c), if—

16 USC  
460uu-44

(1) the owner of such private mineral interests has made available to the Secretary all information requested by the Secretary as to the respective values of the private and Federal mineral interests to be exchanged; and

(2) on the basis of information obtained pursuant to paragraph (1) and any other information available, the Secretary has determined that the mineral interests to be exchanged are of approximately equal value; and

(3) the Secretary has determined—

(A) that except insofar as otherwise provided in this section, the exchange is not inconsistent with the Federal Land Policy and Management Act of 1976; and

(B) that the exchange is in the public interest.

(b) The Federal mineral interests to be exchanged under this section underlie the lands, comprising approximately 15,008 acres, depicted as “Proposed for transfer to Santa Fe Pacific” on the map referenced in subsection (d).

(c) The private mineral interests to be exchanged pursuant to this section underlie the lands, comprising approximately 15,141 acres, depicted as “Proposed for transfer to U.S.” on the map referenced in subsection (d).

(d)(1) The mineral interests identified in this section underlie those lands depicted as “Proposed for transfer to Santa Fe Pacific” and as “Proposed for transfer to U.S.” on a map entitled “El Malpais Leg. Boundary, HR3684/S56”, revised 5-8-87.

(2) As soon as practicable after the date of enactment of this Act, the Secretary shall file a legal description of the mineral interest areas designated under this section with the Committee on Interior and Insular Affairs of the United States House of Representatives and the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be on file and available for public inspection in the offices of the Director of the Bureau of Land Management, Department of the Interior.

Public  
information.

(e) It is the sense of the Congress that all exchanges pursuant to this section shall be completed no later than three years after the date of enactment of this Act.

#### ACOMA PUEBLO EXCHANGES

**SEC. 565. (a)(1)** Upon the request of the Pueblo of **Acoma**, the Secretary shall acquire by exchange any lands held in trust for the Pueblo of **Acoma** (hereinafter referred to as “trust lands”) located within the boundary of the conservation area which the Pueblo

Indians.  
Public lands  
16 USC  
460uu-45.

wishes to exchange pursuant to this section. Such trust lands shall be exchanged either for—

(A) lands described in subsection (c) (with respect to trust lands west of New Mexico Highway 117); or

(B) public lands of approximately equal value located outside the monument and outside the conservation area but within the boundaries of the State of New Mexico which are selected by the Pueblo of **Acoma**, so long as such exchange is consistent with applicable law and Bureau of Land Management resource management plans developed pursuant to the Federal Land Policy and Management Act of 1976.

(2) All lands selected by and transferred to the Pueblo of **Acoma** at its request pursuant to this section shall thereafter be held in trust by the Secretary for the Pueblo of **Acoma** in the same manner as the lands for which they were exchanged.

(3) Any lands west of New Mexico Highway 117 which are acquired by the Secretary pursuant to this section shall be incorporated into the monument and managed accordingly, and section 104 and all other provisions of this Act and other law applicable to lands designated by this Act as part of the monument shall apply to such incorporated lands.

(b) For purposes of acquiring lands pursuant to subsection (a) of this section, the Secretary, consistent with applicable law and Bureau of Land Management resource management plans described in subsection (a), shall make public lands within the boundaries of the State of New Mexico available for exchange. Nothing in this Act shall be construed as authorizing or requiring revocation of any existing withdrawal or classification of public land except in a manner consistent with applicable law.

(c)(1) The Secretary shall make the lands within the areas identified as “**Acoma** Potential Exchange Areas” on the map referenced in section 301 available for transfer to the Pueblo of **Acoma** pursuant to this subsection.

(2) Upon a request of the Pueblo of **Acoma** submitted to the Secretary no later than one year after the date of enactment of this Act, lands within the areas described in paragraph (1) shall be transferred to the Pueblo of **Acoma** in exchange for trust lands of approximately equal value within that portion of the conservation area west of New Mexico Highway 117. The Secretary may require exchanges of land under this subsection to be on the basis of compact and contiguous parcels.

(3) Any lands within the areas described in paragraph (1) not proposed for exchange by a request submitted to the Secretary by the Pueblo of **Acoma** within the period specified in paragraph (2), and any lands in such areas not ultimately transferred pursuant to this subsection, shall be incorporated within the conservation area and managed accordingly. In addition, any lands in that portion of the areas described in paragraph (1) lying in section 1, township 7N, range 9W, New Mexico Principal Meridian, not transferred to the Pueblo of **Acoma** pursuant to this subsection shall be added to and incorporated within the Cebolla Wilderness and managed accordingly.

Public lands.  
16 USC  
460uu-46.

#### EXCHANGES AND ACQUISITIONS GENERALLY; WITHDRAWAL

**SEC. 506. (a)** All exchanges pursuant to this Act shall be made in a manner consistent with applicable provisions of law, including this

Act, and unless otherwise specified in this Act shall be on the basis of equal value; either party to an exchange may pay or accept cash in order to equalize the value of the property exchange, except that if the parties agree to an exchange and the Secretary determines it is in the public interest, such exchange may be made for other than equal value.

(b) For purposes of this Act, the term “public lands” shall have the same meaning as such term has when used in the Federal Land Policy and Management Act of 1976.

(c) Except as otherwise provided in section 505, any lands or interests therein within the boundaries of the monument or conservation area which after the date of enactment of this Act may be acquired by the United States shall be incorporated into the monument or conservation area, as the case may be, and managed accordingly, and all provisions of this Act and other laws applicable to the monument or the conservation area, as the case may be, shall apply to such incorporated lands.

(d)(1) Except as otherwise provided in this Act, no federally-owned lands located within the boundaries of the monument or the conservation area shall be transferred out of Federal ownership, or be placed in trust for any Indian tribe or group, by exchange or otherwise.

Indians.

(2) Except as otherwise provided in this Act, and subject to valid existing rights, all Federal lands within the monument and the conservation area and all lands and interests therein which are hereafter acquired by the United States are hereby withdrawn from all forms of entry, appropriation, or disposal under the public land laws and from location, entry and patent under the mining laws, and from operation of the mineral leasing and geothermal leasing laws and all amendments thereto.

Minerals and mining.

(e) The acreages cited in this Act are approximate, and in the event of discrepancies between cited acreages and the lands depicted on referenced maps, the maps shall control.

(f) The Secretary is authorized to accept any lands contiguous to the boundaries of the Pecos National Monument (as such boundaries were established on the date of enactment of this Act) which may be proposed for donation to the United States. If acceptance of such lands proposed for donation would be in furtherance of the purposes for which the Pecos National Monument was established, the Secretary shall accept such lands, and upon such acceptance such lands shall be incorporated into such monument and managed accordingly.

(g)(1) Capulin Mountain National Monument is hereby redesignated as Capulin Volcano National Monument.

16 USC 431 note.

(2) Any reference in any record, map, or other document of the United States of America to Capulin Mountain National Monument shall hereafter be deemed to be a reference to Capulin Volcano National Monument.

(3) Section 1 of the Act of September 5, 1962 (76 Stat. 436) is hereby amended by striking the remaining portion of section 1 after “boundaries of the monument” and inserting “shall include the lands and interests in lands as generally depicted on the map entitled ‘Capulin Volcano National Monument Boundary Map’ which is numbered 125-80,014 and dated January 1987.”.

(4) Jurisdiction over federally-owned lands within the revised boundaries of the monument is hereby transferred to the National

Park Service, without monetary consideration, for administration as part of the monument.

Indians.  
Religion  
16 USC  
460uu-47.

#### ACCESS

SEC. 507. (a) In recognition of the past use of portions of the monument and the conservation area by Indian people for traditional cultural and religious purposes, the Secretary shall assure nonexclusive access to the monument and the conservation area by Indian people for traditional cultural and religious purposes, including the harvesting of pine nuts. Such access shall be consistent with the purpose and intent of the American Indian Religious Freedom Act of August 11, 1978 (42 U.S.C. 1996), and (with respect to areas designated as wilderness) the Wilderness Act (78 Stat. 890; 16 U.S.C. 131).

(b) In preparing the plans for the monument and the conservation area pursuant to section 501, the Secretary shall request that the Governor of the Pueblo of **Acoma** and the chief executive officers of other appropriate Indian tribes make recommendations on methods of -

- (1) assuring access pursuant to subsection (a) of this section;
- (2) enhancing the privacy of traditional cultural and religious activities in the monument and the conservation area; and
- (3) protecting traditional cultural and religious sites in the monument and the conservation area.

(c) in order to implement this section and in furtherance of the American Indian Religious Freedom Act, the Secretary, upon the request of an appropriate Indian tribe, may from time to time temporarily close to general public use one or more specific portions of the monument or the conservation area in order to protect the privacy of religious activities in such areas by Indian people. Any such closure shall be made so as to affect the smallest practicable area for the minimum period necessary for such purposes. Not later than seven days after the initiation of any such closure, the Secretary shall provide written notification of such action to the Energy and **Natural** Resources Committee of the United States Senate and the Interior and Insular Affairs Committee of the House of Representatives.

(d) The Secretary is authorized to establish an advisory committee to advise the Secretary concerning the implementation of this section. Any such advisory committee shall include representatives of the Pueblo of **Acoma**, the Pueblo of Zuni, other appropriate Indian tribes and other persons or groups interested in the implementation of this section.

#### COOPERATION

Indians.  
State and local  
governments.  
**Arizona**  
16 USC  
460uu-48.

SEC. 508. In order to encourage unified and cost effective interpretation of prehistoric and historic civilizations in western New **Mexico**, the Secretary is authorized and encouraged to enter into cooperative agreements with other Federal, State and local public departments and agencies, Indian tribes, and nonprofit entities providing for the interpretation of prehistoric and historic civilizations in New Mexico and eastern Arizona. The Secretary may, pursuant to such agreements, cooperate in the development and operation of a multiagency orientation center and programs on lands and interests in lands inside and outside of the boundaries of the monument and the conservation area generally, with the concurrence of the owner or administrator thereof, and specifically

in or near Grants. New Mexico, adjacent to Interstate 40 in accordance with the plan required pursuant to section 501.

#### WATER RIGHTS

SEC. 509.(a) Congress expressly reserves to the United States the minimum amount of water required to carry out the purposes for which the national monument, the conservation area, and the wilderness areas are designated under this Act. The priority date of such reserved rights shall be the date of enactment of this Act. 16 USC 460uu-49.

(b) Nothing in this section shall affect any existing valid or vested water right, or applications for water rights which are pending as of the date of enactment of this Act and which are subsequently granted: *Provided*, That nothing in this subsection shall be construed to require the National Park Service to allow the drilling of ground water wells within the boundaries of the national monument.

(c) Nothing in this section shall be construed as establishing a precedent with regard to any future designations, nor shall it affect the interpretation of any other Act or any designation made pursuant thereto.

#### AUTHORIZATION

SEC. 510. There is authorized to be appropriated \$16,500,000 for the purposes of this Act, of which \$10,000,000 shall be available for land acquisition in the national monument; \$1 million shall be available for development within the national monument; \$4 million shall be available for land acquisition within the conservation area; \$1 million shall be available for development within the conservation area; and \$500,000 shall be available for planning and development of the Masau Trail. 16 USC 460uu-50.

Approved December 31, 1987.

## APPENDIX B: SUMMARY OF PUBLIC INVOLVEMENT

Public involvement is an integral component in the formulation of any NPS general management plan. The Park Service is dependent on the public for knowledge, opinions, and advice to facilitate the success of the planning process. Public involvement for the El Malpais National Monument general management plan has been encouraged in a number of ways, including newsletters, workbooks, and public workshops, meetings, and open houses. Public input is also very important to the Bureau of Land Management. Many issues that affect planning for El Malpais influence both the national monument and the national conservation area. Thus, in most instances, the two agencies have coordinated their public involvement processes.

The two agencies have jointly printed a series of newsletters to inform the public of the progress and status of planning. The newsletters (*El Malpais Update*) have been sent to more than 800 individuals and organizations on a periodic basis. All individuals who own property in the monument or conservation area receive the *Update*, as well as area residents. Elected representatives and other public officials: local, state, and federal government agencies; American Indian and conservation groups; and anyone else who has expressed a desire also receives the newsletter. Issues of the newsletter have discussed such topics as the legislative background of El Malpais, the planning process, data-gathering activities, planning issues, safeguarding the cultural heritage, and land protection planning. The newsletters have also announced the times and locations of public meetings, workshops, and open houses.

Public meetings were held in Grants, New Mexico, on June 15, 1988, and in Albuquerque, New Mexico, on June 16, 1988, to solicit public input on the issues that should be addressed in the NPS and BLM general management plans. About 50 individuals attended these two meetings. Questions and concerns were identified in many areas, including American Indian issues, recreation, land acquisition and restrictions, wilderness and road closures, facility development, wildlife management, grazing, cultural resource management, and natural resource management. The issues identified at these meetings were

analyzed and then integrated by the planning teams into the preliminary alternatives for management of the monument and conservation area.

These preliminary alternatives and development options for the monument and conservation area were presented in the *Update* published in early December 1988. Public input on these concepts was solicited in the *Update* through the inclusion of workbooks that presented the NPS and BLM preliminary alternatives in a tabular format. This format allowed easy comparison and included a response form for the public to express their opinions on the most appropriate development and management actions. Workbooks were mailed to everyone on the *Update* mailing list.

Although the NPS alternatives were formulated in consideration of the monument as a whole, the workbook presented the specific elements of each alternative by individual geographic area. Respondents were asked to select the one alternative for each geographic area that most closely matched what they felt would be the most appropriate level of development for that area. A no-action/maintain existing conditions option was included for each area. Space was also provided for respondents to provide further comment or to suggest their own alternatives.

A total of 55 completed NPS workbooks were returned. Although this low response rate did not allow for accurate statistical analysis of the data, the workbooks did provide insight into the public's opinions on the appropriate level of development at El Malpais National Monument. Workbook responses indicated a distinct public preference for those alternatives that emphasized a higher level of facility development and a dispersal of visitor use.

On December 14 and 15, 1988, a second round of public meetings was held in Grants and Albuquerque. Open houses were also held in both cities on the afternoon prior to the actual meetings. The purpose of these open houses and meetings was to present and seek public response to the preliminary alternatives. Approximately 75 individuals attended the December meetings and open houses.

On several occasions members of the planning team met with officials of the Acoma, Ramah Navajo, and Zuni tribes to discuss in detail what tribal concerns should be addressed during planning.

Public involvement will continue to be important to the El Malpais general management planning process. Additional public meetings will be held in Grants and Albuquerque to present the draft plans and environmental assessments.

Two meetings (four workshops) were held specifically in regard to the multiagency visitor center. The results are in appendix G.

## APPENDIX C: MANAGEMENT ZONING – SUBZONING MANAGEMENT GUIDELINES

This appendix contains specific detailed guidelines for the management of subzones of the natural/cultural and monument development zones. The general management guidelines for these zones are presented in the “Management Zoning” section of this document. (A description of the visitor experience relative to the standards of access and interpretation also appears in the “Management Zoning” section.)

### NATURAL/CULTURAL ZONE

#### Primitive Subzone

**General Overview.** Visitors to this subzone will have occasional contact with other recreationists in a natural environment substantially devoid of contemporary human activity and influence. Manipulative resource management activities will be kept to a minimum. Natural processes will occur with minimum alteration or intrusion by humans. Most land that is identified as suitable for wilderness will be categorized in this subzone. The subzone will also include some land that is not classified as suitable for wilderness.

**Visitor Use.** This subzone is oriented toward the visitor who prefers a remote, wilderness-like experience. Use will be primarily by backcountry hikers. Challenge will be high.

The subzone will provide good opportunity for solitude during all times of the year. Contacts between parties will be infrequent to occasional. Evidence of recreational use will be minimal, but apparent in some isolated locations. Individual groups of monument visitors will be limited to a maximum of eight people.

The recreational use of backcountry areas in the primitive subzone will be controlled and monitored by a mandatory permit system. This system will be administered by NPS personnel at a staffed location (possibly the multiagency center or the Bandera visitor center). There will be no charge for the use permits.

All necessary rules and regulations will be communicated to visitors outside of the subzone.

No structured interpretation will occur within this subzone. Contact with NPS personnel will be minimal.

**Access.** The primitive subzone will be roadless. Existing roads and ways will be closed. Access will be by foot and other nonmotorized means only. Exceptions to this norm are detailed below. Travel will be predominantly cross-country, with some marked trails. Trails will be marked by rock cairns or by other natural, unobtrusive materials. Trails will have little or no constructed tread. Signs will be erected only where necessary to ensure the protection of resources or the safety of monument visitors. Orienteering and discovery will be encouraged in areas that can support visitor use. The hiking experience will not, in many instances, be oriented toward specific destinations or points of interest.

Access to the subzone by NPS personnel will also be limited to nonmotorized means, except in emergency situations such as fire suppression or search-and-rescue.

Grazing allottees within this subzone will be permitted reasonable motorized access along approved routes to maintain improvements (such as watering troughs, pipelines, and windmills) until the allotments expire. Motorized vehicles will not be used for routine access or herd management, although the use of horses or other pack animals will be permissible for these activities. The use of motorized vehicles will be prohibited on those federal lands in the primitive subzone that are determined to be suitable for wilderness.

American Indians may use horses and other pack animals to access areas in this subzone for the purpose of observing traditional practices of religion and subsistence activity. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious ceremonies. Consultation between the superintendent and American Indians will be necessary to arrange formal closures.

**Facilities.** No development will be present within this subzone (with the exception of permitted grazing improvements). However, some

undesirable human impacts that occurred prior to the monument's establishment may be apparent for some time.

Backcountry camping areas may be designated, however no tables, tent pads, or toilets will be provided.

## **Semi-Primitive Subzone**

**General Overview.** Visitors to the semi-primitive subzone will have low to moderately frequent contacts with other recreationists. The setting of this subzone will be such that human activity and influence will be minimal, but evident. Manipulative resource management activities will be kept to a minimum, however management actions may be required where impacts from visitors occur. Natural processes will occur with little alteration by humans.

**Visitor Use.** This subzone will be oriented toward the visitor who wishes to reach relatively secluded areas of the monument without having to hike for extended distances. Challenge will be moderate. The subzone will provide encounters with many scenic, largely undisturbed areas of El Malpais, but will not provide the wilderness type of experience available in the primitive subzone.

Off-site interpretation and education will be stressed. Personal/portable interpretive media such as trail guides and pamphlets will be developed for use in this subzone. "On-site" interpretive panels or signing will be limited to those necessary for the protection of resources or for visitor safety. Ranger-led interpretive hikes will be permissible within this subzone.

**Access.** Access to the semi-primitive subzone will be moderate to difficult and restricted to those parties who are able to negotiate rugged, low-standard roadways or those who wish to hike into the areas. High-clearance vehicles and motorcycles will be appropriate modes of conveyance. Entrance to areas within this subzone will be clearly posted as impassable to two-wheel drive sedans and other low-clearance vehicles. Motorized vehicles will be restricted to travel on clearly defined but unimproved dirt roadways. Operation of motorized vehicles off established roadways will be prohibited.

Maintenance of roadways will be limited to that required to protect the terrain and other resources or the safety of the visitor. Some roads will be periodically impassable during rain and other wet periods.

NPS personnel may use motorized vehicles within the semi-primitive subzone for routine patrol and other management activities. Use of motor vehicles by NPS staff in this subzone will be restricted to established public and service roadways, except in emergency situations such as fire suppression or search-and-rescue.

Grazing allottees within this subzone will be permitted reasonable motorized access in areas not otherwise accessible by designated public roadways. Routes crossing federally owned lands will be approved by the superintendent. Use of these routes will be restricted to activities relating to the maintenance of grazing improvements (such as watering troughs, pipelines, and windmills) until the allotments expire. Motorized vehicles may be used for routine access or herd management, provided the vehicles remain on designated public roadways. Deviations from this standard will be the exception and must receive prior approval of the superintendent. The use of horses and other pack animals for routine access and herd management will also be permissible in this subzone.

American Indians may continue traditional motorized access to this subzone for the purpose of observing traditional religious and subsistence activities. When motorized access is required to areas of the monument not otherwise accessible by auto to the general public, consultation and agreement with the superintendent on the proposed route will be necessary. American Indians may also use horses and other pack animals within this subzone for religious and subsistence activities. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange formal closures.

**Facilities:** Minor development will be allowed in this subzone when necessary for resource protection or visitor safety. Permitted grazing improvements will be allowed until allotments expire. Some improvements that occurred prior to the

establishment of the monument may be apparent for some time.

Any campsites within this subzone will be designated. Any high-use campsites (where visitor impacts require mitigation) may have fire rings as well as vault or chemical toilets.

## MONUMENT DEVELOPMENT ZONE

### Rustic Subzone

**General Overview.** Visitors to the rustic subzone will have frequent (moderate to high) contact with other recreationists during the peak-use season. Contacts will be relatively infrequent during the off season. A moderate level of resource management activity can be expected in this subzone to mitigate impacts associated with high visitor use levels. Natural processes will be maintained, but some human alterations and intrusions will be evident.

**Visitor Use.** Opportunities for solitude in the rustic subzone will be occasional to moderate during peak-season weekdays and off season weekends. Opportunities for solitude during peak-season weekends will be rare to occasional. Challenge will be low.

Visitors will be able to stay overnight in a designated rustic campground that will be designed to create a relatively high degree of solitude (although the level of seclusion will not approach that which can be experienced in the backcountry). For those who are not willing or able to manage the rigors of backcountry recreation, this subzone will provide an alternative chance to experience the natural beauty and resources of El Malpais. The subzone will also allow visitors to escape the more heavily developed and used areas of the developed subzone. Gravel roads will contribute to the perception of remoteness. Contact with NPS personnel will be moderate to frequent.

Off-site interpretation will be stressed; however low-profile outdoor exhibit panels and signs may be used at specially selected locations to provide information, ensure protection of monument resources, or provide for visitor safety. Ranger-led hikes will be permissible within this subzone.

**Access:** The rustic subzone will provide improved, gravel-surfaced roads that will be accessible by

two-wheel drive, low-clearance vehicles. Access will be moderate to easy. NPS personnel will have full motorized access to this subzone on designated public or service roadways.

Grazing allottees within this subzone will be permitted reasonable motorized access to areas not otherwise accessible by designated public roadways. Routes crossing federally owned lands will be approved by the superintendent. Use of these routes will be restricted to activities relating to the maintenance of grazing improvements (such as watering troughs, pipelines, or windmills) until the allotments expire. Motorized vehicles may also be used for routine access or herd management, provided the vehicles remain on designated public roadways. Deviations from this standard will be the exception, and must receive prior approval of the superintendent. The use of horses and other pack animals for routine access or herd management will also be permissible in this subzone.

American Indians may use motorized access to areas of this subzone for the purpose of observing traditional religious and subsistence activities. When motorized access is required to areas of the monument not otherwise accessible by auto to the general public, prior consultation and agreement with the superintendent on the proposed route will be necessary. Horses and other pack animals may also be used within this subzone to provide access to the area for religious and subsistence activities. Certain areas may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange formal closures.

Trails within the rustic subzone will generally conform to the standards presented for rustic trails in appendix D.

**Facilities.** Limited facility development in the form of modest interpretive shelters, low-profile interpretive panels and informational signs, trailheads, trails, and primitive vehicular campgrounds will be permissible.

Campgrounds will be accessible by automobile, however campsites will be limited to a modest size. This might limit the use of the campgrounds by larger RVs and trailers. Campsites could include fire rings, picnic tables, and vault or chemical

toilets. No potable water, electricity, or sewer connections will be provided within the campgrounds.

## **Developed Subzone**

**General Overview.** Visitors to the developed subzone will have very frequent contact with other recreationists during the peak season. Contacts will be somewhat less frequent in the off season, but will still be high compared to other areas of the monument. A high level of resource management activity can be expected in this subzone to mitigate impacts associated with high levels of development and visitor use. Natural processes will be encouraged where possible, but significant alterations or intrusions by humans are likely to be evident.

**Visitor Use.** The developed subzone will provide the primary experience for the majority of visitors to El Malpais. There will be little or no opportunity for solitude during either the peak or off seasons. Interparty contacts in this subzone will be high. Contact with NPS personnel will be frequent. Challenge will be low.

Guided tours, interpretive trails, films, slide programs, exhibits, and publications will be used to convey an understanding of the resources of El Malpais. Orientation and information will also be provided to assist visitors in planning their stay in the monument and in west-central New Mexico.

**Access.** The developed subzone may have both surfaced and unsurfaced roads. All public roads will be accessible by two-wheel drive, low-clearance vehicles. Trails will allow visitors to discover a range of environments and features. If feasible, some of these trails will allow for access by individuals with mobility impairments.

Certain areas within this subzone may be periodically closed to the general public for short periods of time for the observance of traditional American Indian religious activities. Prior consultation between the superintendent and American Indians will be necessary to arrange such closures.

**Facilities.** All major facility development will be in this subzone. Comparatively significant modifications will be made to the environment;

however, as much of the natural and cultural integrity of the area will be preserved as possible. Examples of facilities that will be included in the developed subzone are visitor centers, surfaced parking areas and roads, maintenance facilities, and housing.

## **APPENDIX D: TRAIL STANDARDS AND DETAILS OF PROPOSAL TRAIL SYSTEM**

### **INTRODUCTION**

Trails in El Malpais National Monument will be built at four different standards, each corresponding to an approximate volume of use, maintenance priority, level of accessibility and skill, and the four subzone levels of visitor experience stated in the "Management Zoning" section. The standards were created to provide for public safety and offer a variety of trail experiences. Because El Malpais is a volcanic area; special lava flow trail construction strategies may be used with any of the four standards for reasons of public safety or resource protection.

### **PRIMITIVE TRAILS**

Primitive trails will be marked routes for low volumes of experienced backcountry hikers. The trails will be used for access to backcountry resources and scenic areas. There will be no feature interpretation (with the exception of self-guiding publications) and trail markers or cairns will be commonly used for direction, visitor safety, and resource protection.

Primitive trails will have the lowest priority for maintenance. Trails will have little or no tread preparation, and only minor brushing to the tread margin, where necessary. Trails will have an overall grade of less than 15 percent and normally not exceed 20 percent for distances less than 150 feet. Width will not normally exceed 2 feet. Natural lava rock, unless it is extremely rough or abrupt and potentially dangerous, may serve as the walking surface. Some upgrade of the trail standard will be permitted if the route is in an ecologically sensitive area (i.e., wetland) or crosses brutal terrain.

### **SEMI-PRIMITIVE TRAILS**

Semi-primitive trails will be hiking routes that can accommodate low to intermediate volumes of visitors who have intermediate to high ability and hiking experience. The well-marked trails will be primarily destination-oriented, serving as access to special resources and scenic areas, with minimal or

no interpretation. Trail routes will be designed to provide for visitor safety while minimizing erosion.

Semi-primitive trails are third in maintenance priority. Often, the tread will not be smooth, having a natural dirt, rock, or cinder surface, and will be no less than 2 feet wide. Vegetation will be cleared 6 inches beyond the tread margin, where feasible. These trails may use footbridges, corduroy elements, and water bars. The overall grade will be less than 15 percent and not exceed 18 percent for distances less than 150 feet. Natural lava rock will be incorporated into the alignment unless the surface is extremely rough or there are abrupt and potentially dangerous grade changes. Where these trails ascend long steep slopes, they will be aligned carefully so as to minimize the potential for hikers to shortcut switchbacks.

### **RUSTIC TRAILS**

Rustic trails can be hard-surfaced or gravel (cinder) routes that can accommodate intermediate to large volumes of visitors with average physical abilities to important attractions in the monument. Rustic trails will be well marked, and some interpretive information may be provided. They will be constructed to provide for visitor safety while minimizing erosion.

Rustic trails will have second priority for trail maintenance. Minimum tread width will be 3 feet, with the overall grade less than 10 percent and not to exceed 15 percent for distances less than 150 feet. Vegetation will be cleared 1 foot beyond the trail margin, where feasible. These trails may use footbridges, corduroy elements, and water bars, and have trail-side benches where needed. The trail tread will be relatively smooth and free of extreme variations and abrupt rock and root protrusions. Natural lava rock may be incorporated if the surface is hard and relatively smooth. Lava cinders may also be used as a trail surface. Careful attention to combine natural landscape materials and colors will always be a design and maintenance priority.

## DEVELOPED TRAILS

Developed trails are hard-surfaced and meet Uniform Federal Accessibility Standards (UFAS), accommodating large volumes of people en route to popular destinations. All developed trails will be accessible to people in wheelchairs (unassisted) and will be carefully routed and constructed. A relatively large amount of interpretive information may be presented along these trails. These trails will provide for visitor convenience and minimal degradation of the natural and cultural resources. Because these trails may be heavily used by visitors with limited physical abilities, benches and shade/rain shelters will be incorporated along the route at strategic locations.

Developed trails will be given the highest maintenance priority. These trails will not exceed 5 percent (except that ramp sections will not exceed 8 percent). Tread width will be a minimum of 5 feet on one-way loops and 6 feet on two-way trails. These trails will drain well, with a cross slope not to exceed 2 percent. Vegetation will be cleared 1 -1/2 feet beyond the tread margin, where feasible. Typical materials may include nonslip or aggregate concrete, asphalt, soil binders, boardwalks, and bridges in harmonious combination. Natural lava rock may be used for tread only if the surface texture and grade conform to UFAS. Lava cinders may be used with a translucent binder if feasible. Preference will be for natural landscape materials and colors to ensure compatibility and visual integrity.

**Table D-I. Proposed Trail System at El Malpais National Monument – Standard and Length (mi)**

<b>Area/Name</b>	<b>Developed</b>	<b>Rustic</b>	<b>Semi-Primitive</b>	<b>Primitive</b>
<u>Multiagency Center</u>				
View trail		0.5		
<u>Bandera Crater Area</u>				
Visitor center nature trail		0.5		
Dripping Lava Cave		0.3		
Lava Crater			0.5	
Sandstone Ridge			2.0	
Sandstone Ridge connector				0.8
Ice Cave**	0.2			
Lava surface features	0.5			
Bandera Crater*		0.5		
Bandera Crater connector		0.5		
Spattercone Valley				1.3
Spattercone Valley connector				1.1
Cerro Bandera connector				1.1
Cerro Bandera summit			1.0	
<u>East Rendiia Area</u>				
Lava wall			1.3	
Four-Window/Big Skylight caves			1.5	
Caterpillar/Seven Bridges collapses				1.5
<u>Braided Cave</u>				0.4
<u>El Calderon Area</u>				
Junction Cave			co.1	
Bat Cave	0.3			
Double Sinks	0.2			
Double Sinks-Junction Cave	0.2			
<u>Zuni-Acoma</u>				
Trail to overlook (west)	<0.1			
Zuni-Acoma*				7.0
<u>Sandstone Bluffs</u>	0.1			
<u>Las Ventanas</u>			1.3	
<u>The Narrows</u>				
Lava surface (wheelchair accessible)	0.1			
Lava surface (other)			0.3	
<u>McCartys Crater Viewpoint</u>			0.3	
<b>TOTALS</b>	<b>1.7</b>	<b>2.3</b>	<b>8.3</b>	<b>13.2</b>

Note: Actual length and alignment may vary from those above because of terrain factors and resource protection needs. The future backcountry management plan may identify additional primitive trails that would be added.

\* Existing, no change

■ Upgrade existing trail

## APPENDIX E: GENERAL DESIGN GUIDELINES

### INTRODUCTION

The rugged beauty and deeply rooted cultural heritage of the El Malpais landscape should be complemented by a built environment (roads and facilities) that direct the visitor's attention toward the monument's resources. The goal of these guidelines is to encourage this attention with design consistency and visual quality that communicate a sense of place, including imitation of natural landscape patterns in developed areas and minimization of disturbance to ecological and cultural resources during design, construction, and maintenance.

Because El Malpais is a new national monument with relatively few structures of any type, maximum latitude will be given to the designers to research and develop facilities that reflect sensitivity to the cultural and ecological setting -with the reservation that select architectural and landscape architectural styles be repeated in other developed areas to link the overall visual image of the monument. Any new design should also be realistic in terms of functional requirements for today's management and operational needs and, because baseline data on resources and visitation is relatively lacking, include opportunities for functional flexibility.

The following sections provide an aid to the designer, contractor, Park Service official, and maintenance staff in the decision-making process concerning visual quality, design consistency, and resource sensitivity in the built environment. Designers are also encouraged to review the "Impacts of the Preferred Alternative" section prior to initiating schematic designs. It is recognized that during actual design of roads or facilities, case-by-case variances of some of the recommendations herein may be made to effect the most practicable design solutions.

### ARCHITECTURAL ELEMENTS

Because there are no large facilities of any kind within the monument, an extensive study of regional vernacular architecture should be made prior to developing the schematic designs. Examples of regional mountain style architecture

should be considered in designing buildings in the **Bandera** area. Buildings should be sited so that existing significant views or vistas are preserved. Structures should take advantage of available views, but also consider sight lines back to the structure. Placing a structure between an established or potential approach and a significant resource should be avoided. Native vegetation should be used to screen service areas as needed.

The design of the multiagency center may differ from that of the **Bandera** visitor center, primarily because of the climatic, scenic, functional, and operational needs. Facilities within the monument should rely on solar energy, where feasible. Water conservation is important, so water-conserving appliances and irrigation should be seriously considered. The following sections elaborate on major proposed facilities.

#### Major Public Facilities

The multiagency center should be built in a representative style of regional vernacular architecture. The building will be within 0.3 mile of the I-40 interchange area, lessening the expense of connecting utility lines to the city of Grants. The actual site should be adjacent to some minor variation in the otherwise flat landscape. The building's entrance should have a southwest orientation that is visible from the entrance road. Large shaded view windows should be used on southern exposures. Office windows should face the parking lot for security. A small shaded exterior public space should be designed as an element of the plaza for people to view the resource and rest.

Parking for the center should be screened from the entrance road and highway, if feasible. Native shade trees planted in large parking islands should be incorporated to relieve the intense summer heat on vehicles. Distinct spatial transitions should separate the parking area from the plaza and entrance area.

Solar orientation should be a major design factor in roof design (for possible photovoltaic cells), as should some regard for snow and heavy rain. Dense vegetative screening should be used near

the building to “seclude” it from the noisy interchange, and medium screening should be used along the right-of-way adjacent to the industrial park to break the lines of this development. A designated open vista to the south should also be available along the entrance road. Landscaping near the center should be a semi-formal mix of native plants (see Multiagency Center DCP).

The Bandera visitor center should be designed in a style representative of regional vernacular architecture. The building will be on a sparsely vegetated sandstone/volcanic cinder bench above and west of the lava flow margin. The entrance to the visitor center should have a southern exposure, and the view deck (approximately 500-600 sq ft) should face east, overlooking the lava flow, forest, Lava Crater, and Cerro Candelaria. The view deck may wrap around the building's south side.

The entrance area should be easily distinguishable and spatially distinct from the parking area. The parking area, broken into several smaller areas if feasible and located south or southwest of the building, should not interfere with the view of Lava Crater from the deck. The entrance area should have a separate small exterior public space for people to sit and relax.

Solar orientation should be used in roof design (for possible photovoltaic cells), as should a pitched roof to mitigate snow accumulation. The building should have large shaded view windows on the north, east, and part of the south side. Interior offices should have windows oriented south and west for security, and display areas should use the soft light of north-facing windows.

The trading post will be rehabilitated for orientation and meeting space. An exterior public space for relaxing should be provided in the picnic area and not adjacent to the trading post.

Site development and formal landscaping, including the proposed drop-off zone and walkways, should be subtle and not dominate the historical scene. Revegetation is needed in the trading post area. New trees, shrubs, and grasses should replicate, where feasible, the historical landscape (see “Landscape Architectural Elements”).

## Government Facilities

The residential area should be designed to encourage a sense of community among residents. Four single-family detached homes for permanent employees and one four-plex apartment building for seasonal employees will be built. Although obviously smaller in scale, the form, facade, color, materials, and texture should avoid inconsistency with the Bandera visitor center. Interior design should allow for individual family functional flexibility and views from windows. Views and roof angles (for possible photovoltaic cells) should be a prime consideration in specific site location.

Parking areas should be designed to decrease their noticeability. Landscaping for the new houses should incorporate native plants; preserve biotic diversity; define outdoor space; use native, drought-tolerant grasses for yards (each house should have its own private yard), and offer well-landscaped, distinct transitions from the parking areas to entryways. The residential area site plan should include a designated area away from the entry road for community recreation, e.g., a small turf area for volleyball, bar-be-cue, etc.

The maintenance area, within 0.3 mile of the residential area, should consist of one large building and one small storage shed. The actual site should be topographically or vegetatively screened from the residential area and the Lava Crater viewpoint, if possible. The entrance should be on the south to minimize ice on entryways, and the roof should be oriented for possible installation of photovoltaic cells. The large building should include adequate room for firetruck and ambulance parking, dry material storage, a workshop, fire equipment storage, a unisex restroom, general supply storage, and enough space for several workstations.

The paved maintenance yard should include ample parking for vehicles, including firetrucks and heavy equipment. The yard should have a truck wash area, fuel pumps, and material storage area, and be fenced for security. The yard may be of a nontraditional shape to allow for preservation of vegetation. A helicopter landing area should also be considered during design.

The water storage and delivery system -wells, storage tanks, and water treatment facilities, including access roads – should be hidden from

public view. The partial or full burying of tanks should be considered and any remaining aboveground structure should be hidden with an appropriate facade or painted with earth tone and forest colors.

## LANDSCAPE ARCHITECTURAL ELEMENTS

The design of roads, parking areas, trails, vegetation, vista clearings, and exterior public spaces should contribute as effective links between the natural form and the built form. This would be done by harmonizing the patterns and biotic diversities found in the landscape with the form, mass, scale, color, and textures of facilities. Although architectural styles may differ, signs, waysides, lighting, street furniture, trash receptacles, etc., should be similar in appearance throughout the monument. The following sections provide guidelines for major landscape elements.

### Roads

Roads in the monument will be designed to interfere as little as possible with natural processes and biotic diversity. Although the preferred alternative's various development concept plans show suggested routes, much latitude should be taken to locate the actual alignments. The alignments should allow the driver to rhythmically focus on appealing views while peripheral distractions are screened (visual sequence). An appropriate visual sequence of the alignments should include scenic vistas, primary destinations, and eventually parking. This sequence should be accomplished without the need for a stop sign for through traffic.

Interior park roads will be designed for low-speed travel (25 mph maximum). Small turnouts should be incorporated to facilitate vehicles passing on long tangents or provide parking at points of interest. Vegetation patterns along the routes should be studied, and to the extent possible, replicated in the road embankments. During the design stage, the possibility of bike lanes will be considered.

Design suggestions for several of the major public roads are listed below:

1. The junction of the multiagency center entrance road with the interchange should be easily

visible, but its junction with the parking area should be obscured from the driver heading toward the building. The road should turn toward the entrance, then curve north into the parking area. A small, bilateral roadside contact area of dense native screening will form a "gateway" to the center and help screen the parking area.

2. The junction of NM 53 with the Bandera visitor center entrance road should include deceleration/acceleration lanes. The view from the entrance road should first focus on the lava flow and ecotone, then the visitor center backdropped by Sandstone Ridge. Parking should be somewhat hidden behind the visitor center. The entrance road should meld into the one-way tour road without a stop sign but with opportunities to enter into the visitor center parking or turn around and return to NM 53. The proposed entrance road route will come close to the ecotone of aspens, pinyons, and junipers next to the west margin of the lava flow. Design alternatives should mitigate wherever possible the disruption of surface runoff patterns and the ecotone's water source.
3. The one-way Bandera tour road should be designed for low-speed (25 mph) and focus the driver's attention on views of the ecotone, the lava flow, Lava Crater, Cerro Candelaria, Cerro Bandera, Bandera Crater, and other scenic vistas. If determined feasible during design, pullouts should be added at scenic areas. The tour road should not have any stop signs until reaching NM 53, although it should have turn lanes for the Dripping Lava Cave road and the trading post parking area.
4. The Dripping Lava Cave road will be a short, two-way paved road leading to a parking area/trailhead. No pullouts should be necessary on this short road, and the parking area should be large enough to accommodate turning radii of tour buses. Widening the short road cut through the lava flow will be necessary, but careful attention to keep the cut natural looking should be specified in the design.
5. The realignment of County Road 42 (first 2 miles) should adhere to the form of the land and minimize interruption of ecological systems. Because parts of the road surface may be in the shade of Cerro Bandera during the winter

months, mitigation of snow accumulation should be considered in design and alignment.

## Parking Areas

Parking layouts, like roads, should respond to the topography in a complementary form. Even though El Malpais does not require massive parking areas, arched or curvilinear layouts and small parking areas (rather than large asphalt areas) should be used to reduce the perceived size.

Large, vegetated parking islands should visually link native vegetation patterns with the built environment. Parking islands should be designed parallel to the line of foot travel toward the main destination they serve and should be wide enough to support a variety of native vegetation. To lessen the impact of trampling by visitors, islands can be shielded by

- increasing (or decreasing) the planting grade to the soil's angle of repose

- incorporating natural barriers, e.g., rocks and dense plant materials

- using subsurface irrigation techniques and soil treatments to combat compaction

- raising the curb height from the standard 6 inches

Snowpole holders are necessary in the design of all roads, walkways, and curbs and gutters.

## Walkways

Pedestrian walkways should be spatially distinct from vehicular circulation and integrated into the landscape form. Safe walkways and paths should invite the visitor into well-defined use areas through a logical sequence of spatially distinct experiences and views; natural features should dominate where feasible. Edges of use areas should be well defined. Exterior public spaces, especially spaces adjacent to the entry of the visitor centers, should be spatially distinct and offer sitting areas, drinking fountains, and other amenities to invite the visitor to relax and enjoy the blend of the built and natural environments.

## Vegetation

Trees and shrubs grown or transplanted from the natural environment should be considered for parking islands and general landscaping. Outside sources of native forbs and grasses should be approved by the park staff prior to use in revegetation.

In any planting scheme, careful attention should be given to the immediate environs. Although similar species are found at both the **Bandera** visitor center site and the trading post area, the pattern and frequency of natural distribution will be different, especially in the lava flow margin ecotones. Imitating the immediate environs helps mitigate disturbance of biological continuity and preserve the sense of place.

In areas of snow removal, conifers should be planted back from the road's edge to minimize denuding by the heavy snow loads caused by snowplows. Because roadside encroachment by new growth may be inevitable, a transplant program for young, unneeded trees should become a standard maintenance procedure.

Vista clearings are permissible to enhance the visitor's appreciation and understanding of the natural/cultural landscape. Proposed vista clearings should be reviewed by monument managers in consultation with a landscape architect.

Several criteria should be considered when clearing a vista.

- The key view areas along roads and trails, and at other facilities should be defined.

- The area to be cleared should be viewed from the key viewing area and from the area back toward the viewpoint. This is important because vegetative screening may be necessary to block undesirable elements in the return view, e.g., parked cars and utility lines.

- All trees and shrubs do not necessarily have to be removed. A representative diversity of tree heights and species may be necessary to minimize interference with ecological and biological systems. Vegetation under a specified height (generally young trees)

should be left alone and checked for height every five years.

Abrupt forest edges next to cleared areas should be avoided; a soft, graduated blending of clearing and forest should be used. The minimum length of a clearing should be established on an individual basis.

Once the initial major facilities are designed, a more refined set of design guidelines and maintenance procedures should be prepared to further protect visual quality and resource sensitivity in the monument.

## APPENDIX F: VISITOR CENTER FUNCTIONS, SIZE REQUIREMENTS, AND INTERPRETATION DETAILS

### MULTIAGENCY CENTER

#### Functions

As described in the proposed plan, the new visitor center will contain these functional areas for public use:

- Information/reception/circulation area
- Cooperating association sales and publication display area
- Travel planning area
- Exhibit area with audiovisual (AV) units, in alcoves and/or as part of an exhibit
- AV theater
- Plaza and start of short interpretive trail
- Public restrooms

The information/reception area will contain an information desk, orientation exhibits to features and activities in the area, a sales publication display area, and identification of the different agencies involved; it will also provide circulation space for visitors coming and going from the exhibit area, AV theater, and the travel planning area. It is important that the entrances to public restrooms be located so that this function does not add congestion to the information/reception area.

The sales and publication display area will be out of the main circulation area but in eye control of information desk personnel. Storage, safe, and workspace for the association will be near the sales area, and the cash register will be at the information desk.

The travel planning area will be a self-service area/alcove off the reception/information area. Informal seating/work tables will be available for visitors developing travel plans. Basic free literature and maps covering the El Malpais, the Grants/Milan region, and the Masau Trail should be available, along with information relative to the amount of time/effort needed to visit and participate in each combination of areas or activities and relevant visitor safety and resource protection information.

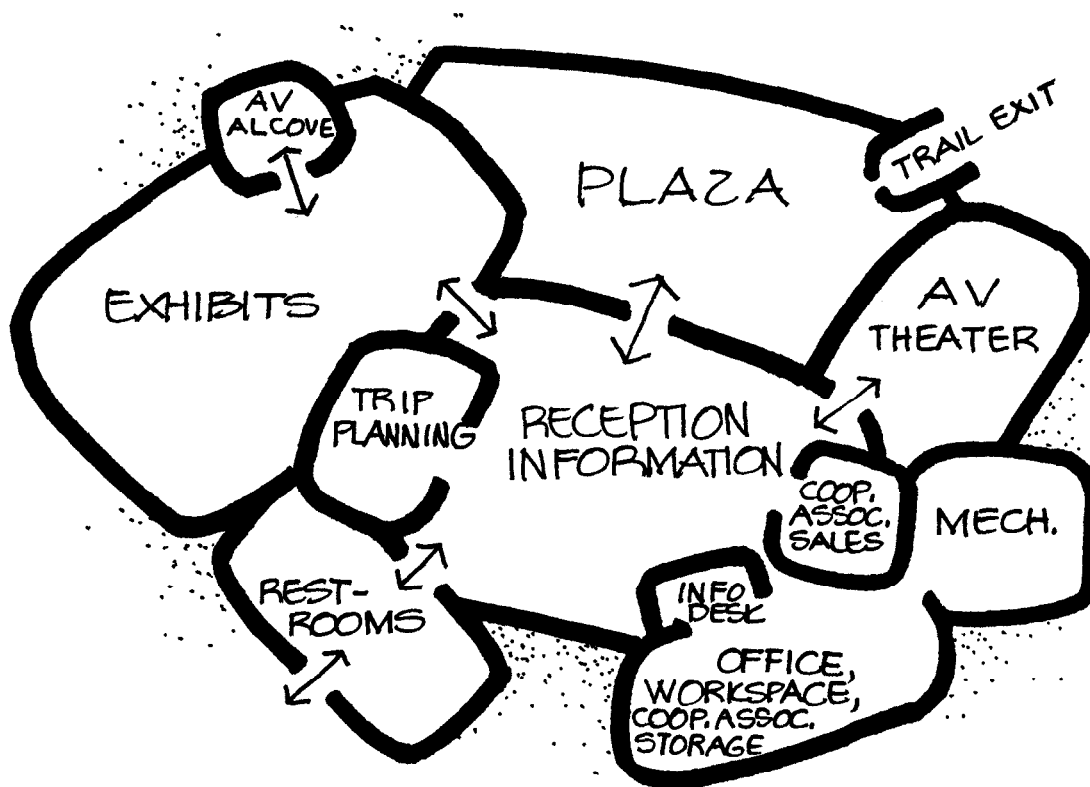
A 50-seat AV theater will be located off the reception/information area. It will be used for

showing a film about the Masau Trail as well as multiple offerings of other relevant AV programs dealing with the resources of the region.

A plaza adjoining the building, with informal seating (benches or a low wall), will serve as a meeting area for groups, a waiting area when some members of the group are using the trail or the trip planning facility, and as an informal personal services area for occasional talks and/or demonstrations by American Indian craftspeople. A short interpretive trail, for visitors to stretch their legs and get a visual orientation to the resource, will start from the plaza. Other amenities, such as a picnic area, outdoor amphitheater, and longer interpretive trails, will not be developed at the visitor center site. Instead, visitors will be directed to such facilities in the surrounding area.

A small office/working space for employees, located so that during the off season the employees manning the building can accomplish other work while also watching the information desk and sales area, will be a part of the center. An additional small office/work area/library will also be provided for employees and staff from other agencies or volunteers. This will be the limit of administrative space in the structure.

The following graphic shows the functional relationships in the public use spaces of the proposed new multiagency center.



## Size

The following square footages were determined for the various functional areas in the center.

Information/reception/circulation	1,000 sq ft
Cooperating association sales and display	300 sq ft
Association storage and work space	200 sq ft
Travel planning area	500 sq ft
Exhibits, AV alcove	2,150 sq ft
AV theater	500 sq ft
Public restrooms (2-3 stalls for males, 4 for females)	600 sq ft
Office and workspace (office = 150, workspace = 200)	350 sq ft
Mechanical	600 sq ft
<b>TOTAL</b>	<b>6,200 sq ft</b>

These figures anticipate only office and workspace for the visitor center staff; office space for the management and administrative staff of the Park Service and/or the Bureau of Land Management will be provided in Grants.

## Details of Interpretation

The opportunity to "experience the Southwest," its rugged landscapes and American Indian cultures - both prehistoric and contemporary - has long been the primary motivation for travel and tourism to this region of the country. The primary resources of the El Malpais National Monument and National Conservation Area, specifically mentioned in the establishing legislation, are the nationally significant Grants lava flow and the Las Ventanas Chacoan archeological site (the southernmost outlier site of the Chacoan culture) -the same primary motivating factors as for the Southwest in general. Therefore, the exhibit area in the visitor center will deal with the rugged landscapes and the human record of occupation from the prehistoric Chacoan and other Anasazi groups to the contemporary American Indian cultures of the area. Concentrating on these two primary interpretive themes will allow the center to present a core interpretive message applicable to the resources of the local region and the Masau Trail as well as those of El Malpais.

Masau Trail orientation exhibits will include a wall-sized stylized map of the Masau Trail, with large photo inserts of the different areas involved. Additional exhibits will be developed for each of the shorter 1- to 3-day loop routes, each focusing on a particular prehistoric cultural group and identified interpretive theme. There are eight such cultural groups identified in the preferred alternative for the Masau Trail, but there may be as many as 11 by the time the planning and trail layout is finalized.

In the interfaces of the reception area, trip planning area, and exhibit area could be large topographic relief models/graphics (orientational or interpretive) that depict

the El Malpais lava field bounded by the Cebollita Mesa on the east and the Zuni uplift and Chain of Craters on the west

the larger region – its primary landforms and resources – an area bounded by the Acoma and Laguna reservations to the east, the Ramah Navaho and Zuni reservations to the west, the Cibola National Forest and Chaco Cultural National Historical Park to the north, and the Cibola County boundary to the south

The depiction of the El Malpais lava field will be designed so that geology is a component, but the regional model/graphic unit will be primarily designed to orient visitors and interest them in traveling to the various sites depicted.

Exhibit planners and designers could keep in mind that the monument/conservation area will be changing rapidly, at least from the facilities development point of view. Initial information/ orientation panels may very well have to be changed more than once in the next five to 10 years. The same consideration holds for the Masau Trail.

Wayside exhibits will be located to interpret the resource visible from the plaza.

Outside the visitor center but protected from the weather there will be a bulletin board/information panel for posting information of a changeable nature. The need for after-hours information can be handled through this media. There will also be wayside exhibits explaining the resources, as appropriate, along the interpretive trail.

Exhibits will be produced on the following topics.

## The Land

**The Landscape** – The topographic relief model/graphics of the El Malpais area and region already described above for the interface of the reception/information area and the exhibit area could describe the landscape.

**Geology** – Geology exhibits could include lava and other rock samples and graphics coupled with video units that demonstrate the major geomorphological events that created the landscape of today and their relationships to the various destination sites in the region, the El Malpais area and along the Masau Trail. Videos could be silent, perhaps with captions, and viewed by standing visitors. (Note: this exhibit should be designed more to encourage visitors to go see the “real thing” than to actually teach much about geology, but enough information should be included to encourage site visitation.)

## The People

**Cultural Groups** – There could be an exhibit to identify the American Indian cultural groups that have occupied this area (the Masau Trail region) from prehistoric times to the present using a combination of artifacts, photographs, and graphic materials. Current reservation boundaries as compared with earlier Indian territories could also be depicted.

**Occupation History-There** could be a time duration and placement-in-history exhibit to introduce visitors to the long time span involved in the occupation and use of this area by the different cultures. The Acoma have lived in Sky City for about 800 years, in contrast to the approximate 400-year span for the entire colonial and national history of the United States; the early Anasazi cultures are even more ancient. The arrival and tenure of Europeans and the eventual BLM and NPS stewardship could be included in this time-line history. This exhibit could also place these cultural groups in world history, cross-referencing them with events that were occurring in other parts of the world (Central/South America, Europe, etc.) during the same time period.

**Chacoan Outliers** – One exhibit will present an overview of the Chaco era (A.D. 900-1150), identifying Las Ventanas as a Chacoan outlier and placing it in context with Chaco Canyon and the other 70+ Chacoan outliers in the region. This exhibit will create an awareness that Chaco Canyon (the hub of the Chaco civilization) and its outliers (detached units scattered over a 20,000-square-mile area) constituted a complex and far-reaching social, economic, and cultural system that was regional in nature and greater than the sum of its parts. The visitor will understand from the exhibit that these outliers were small communities with multistory dwellings, associated smaller (detached) dwellings, kivas, irrigation systems, connecting prehistoric roads, and signaling stations. The Las Ventanas site and features may then be contrasted with other outliers. Because there are more questions than answers, visitors may be encouraged to theorize what role Las Ventanas played in this regional system. An assortment of artifacts will support this exhibit, providing a rich visual association with this prehistoric period.

### **For the Sake of the People - For the Sake of the Land**

**A Special Place** – An alcove in the exhibit area could be used for a video program that deals with the relationships, understandings, and feelings of the different peoples for this land -this “special place.” The video could be structured around a panoramic scene of the El Malpais with a number of different speakers – representatives of the Acoma, Zuni, Ramah, and Laguna tribes, the Park Service, the Bureau of Land Management, ranchers, etc. – discussing what they see, feel, and value about the land. It would not be possible to teach or even cover superficially the differing philosophies or beliefs of the different peoples and/or organizations, and no attempt should be made to accomplish this. The objective should be to produce a kind of “Whitman Sampler” to point out that there are differences and that they are all valid within their context, that we should all respect others’ viewpoints, and, most importantly, that we should respect the land and the resources we share in common. This exhibit could be very specific to El Malpais and its relationship to

the region and to the Masau Trail, and this could be the overall message visitors gain from it.

The following quotes (extracted from notes taken during a meeting on October 17, 1988, between the Park Service, Bureau of Land Management, and representatives from the Acoma, Zuni, and Ramah Navaho tribes when discussing interpretation at El Malpais) are examples of the kinds of messages that this video exhibit could attempt to impart. (They are not offered as the text for the exhibit/video, but just as examples.)

“When we look we feel that region. We want respect and love to come about, for people to know that there is a quality that is awesome, significant about the land and about himself.” (Acoma)

“...yes see the land and appreciate it, but know there is something else, that we share the responsibility to love it, to protect it, to respect it.” (Acoma)

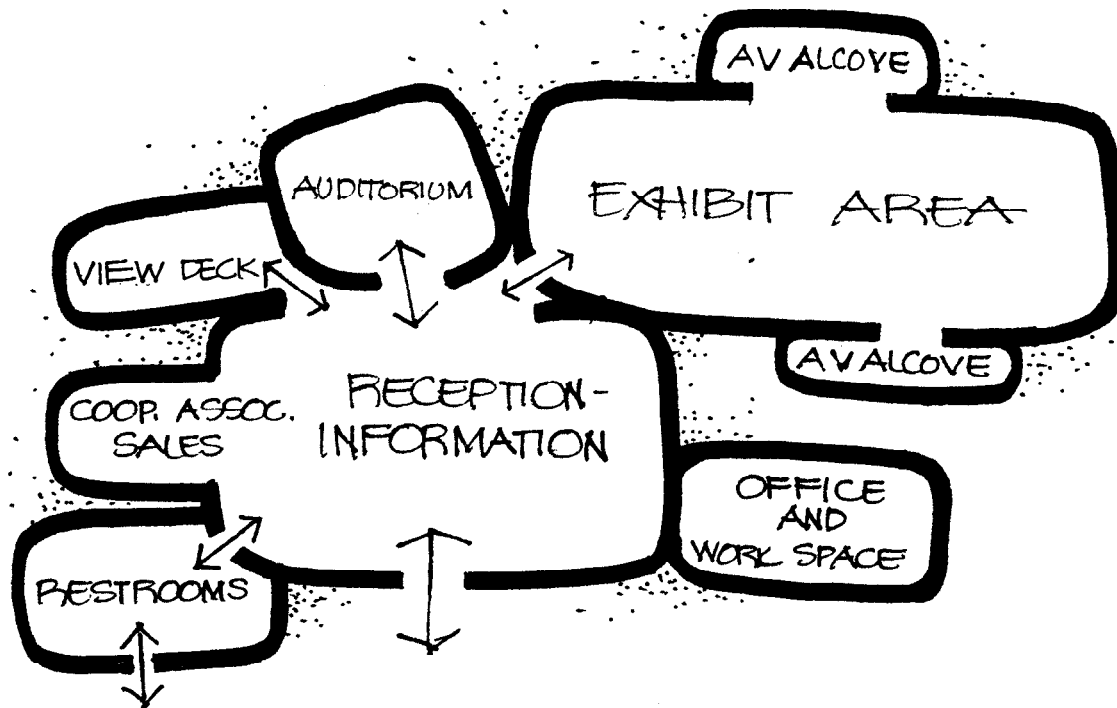
“We need to develop a sense of responsibility. For the sake of the people, for the sake of the land, make people a part of the responsibility.” (Acoma)

“To learn to respect, to love the land takes a long time. Our people have been part of the land for so long; help people understand what this means.” (Ramah)

“Basically we all see the same, believe the same, except for the different interpretations that come from our different cultures”. (Zuni)

“This is a special place. What we want is for people to come to love it, to respect it. The land echoes in my mind, in my heart, in my spirit.” (Acoma)

The program could last five minutes or less, be visitor-activated, and the alcove could be separated and buffered to prevent sound spill because of the narration.



## BANDERA VISITOR CENTER

### Function

As described in the proposed plan, the new visitor center will contain these functional areas for public use:

- information/reception/circulation area
- Cooperating association sales and publication display area
- Auditorium
- Exhibit room
- AV units, in alcoves and/or as part of an exhibit
- View deck and start of short interpretive trail
- NPS office space/workrooms and storage area
- Public restrooms

The information/reception/circulation area of the visitor center will contain an information/reception desk and trip planning graphic (topographic map or model concept) that orients visitors to the national

monument and conservation area. An exhibit will convey safety information and will be placed in a prominent location in the information/reception lobby. It is important that the entrances to public restrooms (accessible from both inside and outside the visitor center) be located so that this function does not add congestion in the information/reception space. Adequate circulation space will be provided for visitors coming and going from the exhibit area. The sales and publication display area will be out of the main circulation area but in view of the information desk personnel. Storage and a small work space for association personnel should be near the sales area.

The core experience for all visitors who stop at the visitor center will be the AV presentation. A 50-seat auditorium will be provided, and the exhibit area will complement the AV presentation by highlighting selected components that comprise El Malpais' cultural landscape.

Space will be provided for four NPS offices (one maintenance office and three ranger offices). The

visitor center will also provide a library/workroom space for NPS personnel, NPS storage space and conference room, a first aid room, and a small workroom/storage space for the cooperating association.

A small view deck with informal seating adjoining the building will serve as an area for visitors to relax in the out-of-doors before continuing their trip. This view deck will also serve as a trailhead for an interpretive trail that will take visitors to the edge of a lava flow and another trail that will lead to the top of Sandstone Ridge.

The functional relationships in public use spaces will be as follows:

**Size**

Information/reception/circulation	1,500 sq ft
Cooperative association sales and display	300 sq ft
Cooperative association storage/workspace	300 sq ft
Public restrooms	600 sq ft
Auditorium (100 seats)	1,000 sq ft
Exhibit area/video alcove space	1,500 sq ft
NPS office space (4 offices)	600 sq ft
Library/workroom	400 sq ft
Storage	400 sq ft
NPS restroom	200 sq ft
Conference room	200 sq ft
First aid room	50 sq ft
Mechanical	500 sq ft
	<b>7,550 sq ft</b>

**Details of Interpretation**

**Audiovisual.** The visitor center AV presentation will convey a distinctive mood and the message that El Malpais is a special place. This AV will be more than a geology story with a little human history thrown in. This rugged landscape will be portrayed in the “world view” where land and culture are one. The AV should invoke a feeling and attachment to both the landscape and the American Indian people who have occupied it over the past 1,000 years. This story will focus on El Malpais as a cultural landscape and will encourage the audience to “read” and appreciate this landscape and its creation, as well as the cultures that have been and are today inextricably part of its evolution. Religious activities, directional and geographic symbolism, legends, and storytelling (tribal assistance and review required) are all possible vehicles to portray

portions of this story. The program will provide the audience a window into the world view of other cultures with the purpose of presenting the relationship between American Indian people and the land. If successful, subtle intangibles might pervade beyond this experience to encourage us all to look at things in a different way – with a deeper and continuing respect for all humans in our surroundings.

**Exhibits.** One portion of the exhibit area would emphasize the evolution of landforms. The El Malpais lava flows are among the most significant volcanic areas in the United States.

One exhibit will use techniques to give scale and dimension to this volcanic landscape, allowing the visitor to grasp the boundaries, expanse, and contrasts (sandstone formations vs. lava flows) of this unusual area. The Sandstone Bluffs site on NM 117 may be highlighted as the best location for a dramatic panorama of El Malpais.

Video units can be used to demonstrate the formation of the different types of lava surface features, lava tubes, and lava tube systems. For example, lava features at El Malpais may be shown, and then the same type of active features at Hawaii Volcanoes National Park may be spliced in to provide contrast (as is done at Lava Beds National Monument).

An exhibit/video technique will also show the sequence of individual flows at El Malpais, cross-referencing the time period of these flows with other regional, national, or international events in time.

Another exhibit will graphically identify and locate these different volcanic features and encourage personal discovery of these and other features.

Some of the most interesting ecological adaptations that plants and animals have made to survive in this harsh environment will be presented in an exhibit. Certain areas host enclaves of wildlife and plants especially adapted to conditions in El Malpais, including some species not commonly seen in the region. Briefly, the collage of topics may include the following:

**Bats** -Although visitors will not go into Bat Cave, they will be told about the bat flights at El Calderon. A few basic facts about their life cycle as it pertains to El Malpais will be provided.

**Kipukas** – Because these features are in more remote areas of the lava flows and are not easily accessible, most visitors may never see a kipuka. An exhibit will depict kipukas as islands in the middle of a sea of lava, showing them as elevated areas of older land surrounded by lava. A brief description of how kipukas are formed and the unusual habitats found within them may be discussed.

**Inverted Life Zones** – Visitors expect aspen trees growing in higher elevations where abundant moisture is available; they may be surprised to find aspens growing in this seemingly dry, barren lava landscape at elevations where they seem out of place. This exhibit will highlight this inverted life zone relationship, explaining why aspen grow at low elevations on or near the base of the lava with pinyon/juniper (species usually associated with desert-like habitats).

**Diversity** – Although the vegetation in El Malpais has been divided into three common vegetation communities – Douglas fir/ponderosa pine, pinyon/juniper, and Apacheplume – it should be noted that a wide variety of unusual plants and numerous microhabitats occur in this seemingly homogenous environment, hosting a number of faunal and floral species that would not normally occur in the area.

**Dwarf Forests:** Driving along NM 117, visitors will see the twisted trunks, gnarled bark, and the dwarf size of the trees on the lava surface. A brief explanation of this “bonsai” effect is needed.

Another portion of the exhibit area will complement the film by highlighting past and present cultures that have had contact with or have been directly

influenced by the badlands (El Malpais) landscape. American Indian stories tell about the fire-rock and its effect on their lives. No attempt will be made to tell the entire story of any particular culture; however, visitors should grasp that this landscape has been viewed from the perspective of many different peoples. Graphics, artwork, poetry, photographs, appropriate objects, period artifacts, narrative support, and silent video inserts (if applicable) may be used in these exhibits to contrast and compare different cultures. These exhibits will be designed to stand alone and will not be viewed in sequence.

Another exhibit will interpret the post-Chacoan era (A.D. 1300-I 540) up to and including the time of European contact. This exhibit will focus on the late prehistoric period, which witnessed the shift from scattered regional settlements characteristic of the Chaco era (A.D. 900-I 150) to large aggregated communities more like modern-day pueblos. This aggregate settlement period had its own distinctive regional art style, and artifacts will be used to further contrast this cultural transition. The exhibit may highlight the year 1540, which marked the end of the prehistoric period in the Southwest. (Spanish exploration and settlement and the introduction of European diseases, new crops, and domestic animals forever changed traditional American Indian patterns of adaptation.)

An exhibit will interpret those contemporary American Indian cultures that have direct ties to El Malpais. Because some of the large prehistoric communities are recognized as ancestral villages by modern Pueblo people, this exhibit will complete the cultural continuum initiated by the Chaco era exhibit. Working closely with the various tribes, the appropriate exhibit materials, artifacts, and scripts will portray the importance of El Malpais from the perspective of the Acoma, Zuni, Laguna, and Navajo. This exhibit will be designed to stand alone; however, a small associated demonstration area can be used at appropriate times to allow visitors to learn firsthand about the customs, crafts, literature, poetry, and perspectives of the native inhabitants.

Publications will be provided to interpret selected historical and contemporary happenings – a calendar of events that has some tie to El Malpais. Theme treatments will be brief and read like newspaper headlines, with pictures and minimum narrative. Visitors will be intrigued by the procession of history that has passed within view of

these badlands. There will be information about specific publications for in-depth treatment of any particular subject. Topics may include the following:

#### **Exploration –**

- Coronado's expedition to the Seven Cities of Cibola skirted segments of El Malpais. (1540)
- The Dominguez-Escalante expedition (seeking a route to link New Mexico with the northern empire of California) camped at McCartys. (1776)

#### **Western Expansion –**

- The Whipple expedition (to find suitable transcontinental railroad routes) described El Malpais firsthand as a "whole length of valley...threaded by a sinuous stream of lava." (1853)
- The Beale expedition (to locate a wagon route to the Pacific) described El Malpais as a crossing of "many streams of lava, which appear to have rolled in a fiery torrent just as a mountain stream from the hills." (1857)

#### **Settlement, Economic Diversity, and Expansion –**

- Homesteading and the coming of the railroad brought the first hint of "civilization" to El Malpais, permitting the Anglo culture to gain an economic foothold that attracted a slow but steady increase in population. With this new economic era came some of that old wild West charm, with railroad workers, ranchers, cowboys, Basque sheepherders, sodbusters, gold seekers, and lumberjacks. This melting pot of characters all thrived in El Malpais area during the late 1800s and early 1900s.

#### **El Malpais in the Twentieth Century –**

- The 20th century brought little stability to the economy of the area. Various agricultural endeavors and mining for fluorspar, pumice, and uranium brought only temporary relief from a cycle of economic recessions. In 1942 El Malpais was used as a bombing range. Today, with the establishment of the monument/conservation area, local

residents hope that tourism will improve the regional economy.

**View Deck/Trailhead.** A wayside exhibit on the interpretive trail from the view deck may identify the flow as "aa" and explain its formation and source. One panel may explain the abundance and variety of the vegetation (ecotone) that grows along the lava edge because of the higher concentrations of moisture. A connecting short loop trail near a portion of the lava flow will give visitors a chance to see a lava flow first hand.

This view deck will also serve as a trailhead for access to Sandstone Ridge. Visitors will travel a strenuous trail to the top and be rewarded with panoramic views of the **Bandera Crater** area, commanding views of lava in the foreground, and distant views of the other volcanic terrain. Wayside exhibit panel(s) will identify major geographic points of interest with specific attention to features that may have special value to American Indians. From the overlook, visitors may take a trail down the west side of Sandstone Ridge to the **Bandera Crater/Ice Cave** trailhead.

## APPENDIX G: NOMINAL GROUP WORKSHOPS ON EL MALPAIS MULTIAGENCY VISITOR CENTER

Two planning workshops, using the nominal group process, were conducted to assist in developing objectives for the multiagency visitor center. Participants in the first, conducted in Albuquerque on October 19, 1988, were the El Malpais planning teams from the National Park Service and the Bureau of Land Management, with additional representatives from the Acoma Tribe and the NPS regional office in Santa Fe. The second was conducted in Grants, New Mexico, on December 12, 1988, and included representatives from the Bureau of Land Management, the National Park Service (El Malpais and El Morro), the State of New Mexico (Tourism Office and Energy, Minerals, and Natural Resources Department), Grants Chamber of Commerce, City Manager of Grants, Cibola Convention and Visitor Bureau, and the U.S. Forest Service.

The question used at both workshops was "What objectives should be met (services provided) at the proposed multiagency visitor center?"

In both workshops the participants were divided into two groups. Each produced a separate set of recommendations to consider. Summaries of all four groups follow this discussion. No formal group effort was undertaken to merge the results of the four groups, but the 26 final items (seven each from three of the groups and five from the fourth) fall easily into the following generic categories despite the differing wording and emphases developed by each group.

To encourage visitation, appreciation, and protection of the resources of El Malpais National Monument and National Conservation Area.

To function as a travel and tourism, information, and orientation center - not as a destination in itself. The center could serve three geographic zones: El Malpais monument and conservation area, western New Mexico (a radius of approximately 75 miles from Grants), and the Masau Trail.

To help develop an understanding of and respect for the lifeways, beliefs, and

viewpoints of the American Indian groups in the area.

To provide a cooperative opportunity for federal, state, and local agencies to inform the public about the different agencies involved in resource protection in the region and the services and opportunities each provide.

The few items that do not fit into these categories involved suggestions for the design of the facility or the development of interpretive media.

### GROUP ONE (ALBUQUERQUE)

Group one generated an initial list of 50 items for consideration. The list was reduced to 43 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing item numbers in the following list were those eliminated by the above process.

1. Building shape should be designed with input from local Indian groups.
2. Maintenance area for just building and utilities.
3. Outdoor space adequate for demonstrations, benches for relaxation.
4. Restrooms - outside access - locked at night; orientation map adjacent.
5. Excite visitors to see El Malpais and go there.
6. Travel information center, road safety and conditions.
7. Serve to orient visitors to recreational opportunities in El Malpais and western New Mexico.
8. Regional orientation (including Masau Trail) should be secondary function.
10. A combination interpretive break room/project room for center employees only.
11. Focus of wayfinding threefold – El Malpais, western New Mexico region (including others (USFS, state, etc.) who won't be part of Masau trail, and the Masau Trail.
12. Sales area, a cooperating association.
13. Quick idea where to get needs met in Grants.
14. Provide "platform" for each agency to spell out their role.
15. Provide for American Indian presence.

16. Administrative offices kept to absolute minimum.
17. Information on cultural fabric (diversity of American Indian groups) of the region.
18. Large map with Masau Trail "you are here," and tie into El Malpais as part of trip planning/orientation function.
19. Sales item/storage area for sales and free items.
20. Exhibits for Bureau of Land Management to talk about BLM special areas as a way of illustrating multiple use.
21. Audiovisual area/room.
22. Make clear what is at Sky City and Zuni-Cibola and how to get there. More prominent than secondary themes.
23. Exhibits for folktale- stories of El Malpais.
25. Avoid duplication of services and opportunities available elsewhere in the region.
26. Develop one short AV presentation to present El Malpais overview that will entice visitors to see El Malpais (cover the five interpretive objectives).
27. Present theme of respect for the land (NPS, BLM, USFS, American Indians).
29. Design to eliminate administrative functions from intruding on visitor use area.
31. Downplay agency identification and messages in the building and media.
32. Outline summary of policies and protection of restricted areas.
33. Provide facility to handle special talks to large groups, i.e. schools, clubs, etc.
34. Building and exhibits to be fully handicap accessible.
35. Sales area to provide museum quality items
36. Agency outreach should be subordinate to the dominant themes.
39. Make clear the offerings along 117 and 53 and how to divide time between the two.
40. Downplay agency roles.
41. Passive tie to volcanism in the design of the building.
42. Bas-relief map of the immediate region.
43. Coordinate exhibit spaces.
44. Second function, encourage people to change travel plans and stay in western New Mexico.
45. Maximum visitor stay (in the visitor center) should not exceed 45 minutes.
47. Attractive advertisement for brochures, signs, etc.
48. Encourage development of a single brochure on commercial offerings.
49. Interior layout and design accomplished by one architect.

50. Develop logo for El Malpais, and name building – avoiding obscure labels (good public relations and design).

Each group participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows

Item	Ranking Points	Total
1.	1 4	(5)
2.	3	(3)
3.	1 4 3	(8)
4.	0	
5.	5 4 5 5 5 5 5	(34)
6.	2	(2)
7.	1	(1)
8.	5 4 1 1	(11)
10.	0	
11.	5	(5)
12.	0	
13.	0	
14.	2	(2)
15.	2 4 3	(9)
16.	1 1 1 1	(4)
17.	3 3 2 1	(9)
18.	0	
19.	0	
20.	0	
21.	0	
22.	4	(4)
23.	0	
25.	2	(2)
26.	4 5 2 2	(13)
27.	3 3 1 5	(12)
29.	3	(3)
31.	3	(3)
32.	0	
33.	0	
34.	0	
35.	2 4	(6)
36.	2 4	(6)
39.	3 4	(7)
40.	0	
41.	0	
42.	0	
43.	0	
44.	0	
45.	2 2	(4)
47.	0	
48.	0	
49.	0	
50.	3 4 5	(12)

The top seven items in terms of the number of participants selecting the item and the total of the

ranking points were items 5, 8, 15, 17, 26, 27, and 50.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The seven items were ranked as follows.

Item	Scale Points	Total Priority
5.	10 8 10 10 10 10 10 10 10 10 9	(107) 1
8.	8 1 9 5 3 5 6 6 6 7 5	(61) 5
15.	6 7 8 3 7 8 8 8 9 8 6	(80) 3
17.	7 9 8 7 6 6 5 5 8 9 7	(77) 4
26.	5 5 5 1 2 2 7 7 5 7 3	(49) 7
27.	9 10 7 6 9 7 9 9 7 10 7	(90) 2
50.	4 6 4 8 5 9 1 3 4 5 1 0	(59) 6

The seven items in priority order were:

1. To excite visitors to see El Malpais and go there.
2. Present theme of respect for the land (NPS, BLM, USFS, American Indians).
3. Provide for American Indian presence.
4. Information on cultural fabric (diversity of American Indian groups) of the region.
5. Regional orientation should be secondary function (include Masau Trail in secondary).
6. Develop logo for the monument/conservation area and name building, avoiding obscure labels (good public relations and design).
7. Develop one short AV presentation to present El Malpais overview that will entice visitors to see El Malpais (five interpretive objectives).

## GROUP TWO (ALBUQUERQUE)

Group two generated an initial list of 42 items for consideration. The list was reduced to 22 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing item numbers in the following list were those eliminated by the above process.

1. To facilitate resource conservation and protection, including education of visitors.
2. To convey overall themes and perspectives related to the five interpretive objectives identified for El Malpais.
4. Major function as a reception, information, orientation area – not as a destination area – for three levels (El Malpais, region, and Masau Trail).
5. Facilitate public use of area.

6. To provide the public with the knowledge about different agencies involved in its operation.
9. To accommodate special events associated with El Malpais marketing.
10. To arouse peoples' curiosity and engage their feelings as we inform them.
19. Contrasting experiences in space/time. Ties into American Indian world views in design and experiences not just a verbal introduction.
20. To provide public restrooms.
21. To provide complementary, not competitive, services and experiences.
22. To provide use permits.
23. To provide a pleasant and relaxing atmosphere.
24. An imaginative (360-degree orientation) environmentally responsive design both internally and externally.
25. Include ethnobotanical landscaping in design.
27. Interpretive publication sales (Southwest Parks and Monuments Association), not souvenirs; no concession.
28. Provide limited exhibits.
30. To house separate visitor services, administrative, and law enforcement functions.
32. Multiuse entry plaza for demonstrations, presentations, and relaxing.
33. Provide outreach message for involved agencies.
35. To inspire a love for the resource.
36. To facilitate visitor safety.
42. A joint effort with unified results.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows.

Item	Ranking Points	Total
1.	4 4 4	(12)
2.	5 4 5 4 4 4 4 5	(35)
4.	1 5 5 5 5 5 5 5	(36)
5.	4	(4)
6.	2 2 2 1	(7)
9.	0	
10.	4 3 3	(10)
19.	1	(1)
20.	0	
21.	3 3 2 1 3	(12)
22.	0	
23.	3 1	(4)
24.	2 2 3 1	(8)
25.	0	
27.	3 1	(4)
28.	0	

30.	1	(1)
32.	1	(1)
33.	3	(3)
35.	2 2	(4)
36.	1 2	(3)
42.	2 3	(5)

The top seven items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 4, 6, 10, 21, and 24.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The results were as follows.

Item	Scale Points	Total	Priority
1.	8 7 9 9 4 8 6 5 6 5	(67)	3
2.	10 8 10 10 9 9 7 10 10 10	(93)	1
6.	9 10 7 8 10 10 10 9 9 9	(89)	2
10.	7 6 8 8 5 2 3 8 7 6	(42)	7
21.	2 2 5 5 7 4 4 6 5 3	(60)	5
24.	6 5 6 4 8 3 8 7 8 7	(43)	6
		(62)	4

The seven items ranked in priority order were:

1. To convey overall themes and perspectives related to the five interpretive objectives identified for El Malpais monument and conservation area.
2. Major function as a reception, information, orientation area – not as a destination – providing gateway services for three zones (El Malpais, region, Masau Trail)
3. To facilitate resource conservation and protection through educating the visitors.
4. An imaginative environmentally responsive design both externally and internally.
5. To arouse peoples' curiosity and engage their feelings as we inform them.
6. To provide complementary, not competitive, services and experiences.
7. To provide the public with the knowledge about different agencies involved in its operation.

### GROUP THREE (GRANTS)

Group three generated an initial list of 24 items for consideration. The list was reduced to eight items by combining, rewriting, and/or eliminating some of the items during the discussion phase. The missing numbers in the following list were those eliminated by the above process.

1. Role for federal, state, local, American Indian, and private agencies in providing information and/or uniformed staff.
2. Provide information/orientation to western New Mexico's cultural, recreational, natural, and scenic attractions.
3. Provide information on travel necessities, i.e. road, weather, accommodations.
4. Provide a short scenic/nature trail with handicap access at the visitor center to orient visitors to the site.
5. Showcase El Malpais resources with attempt to encourage visitors to stay in the area.
10. Provide visual aids, displays, artifacts, map board, slide programs.
20. Orientation to Masau Trail.
24. No overnight or major administrative facilities provided at the site.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows. (Note: the other three groups selected seven items to carry into the next phase. This group used five because of the small number they started with and the natural break point in the total ranking scores.)

Item	Ranking Points	Total
1.	5 4 1 4	(14)
2.	5 4 3 2	(14)
3.	3 3	(6)
4.	1 5 1	(7)
5.	2 5 2 5	(14)
10.	3 1 3 4 3	(14)
20.	4 2 2 2 5	(15)
24.	1 1	(2)

The top five items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 5, 10, and 20. Each participant was then asked to rank the five selected items on a relative importance scale of 0 (low) to 10 (high). The results were as follows.

Item	Scale Points	Total	Priority
1.	8 9 5 6 6 9	(43)	3
2.	9 10 7 8 9 10	(53)	1
5.	7 6 8 5 7 8	(41)	4
10.	6 8 9 9 8 5	(45)	2
20.	5 7 6 7 10 2	(37)	5

In priority order, the five selected items were:

1. Provide orientation/information to western New Mexico's cultural, recreational, natural, and scenic attractions.
2. Provide visual aids, displays, artifacts, map board, and slide programs (interpretive media).
3. Provide role for federal, state, local, Indian tribes, and private agencies in providing information and/or uniformed staff.
4. Showcase El Malpais resources to encourage visitors to visit the area and stay longer.
5. Provide orientation to the Masau Trail.

## GROUP FOUR (GRANTS)

Group four generated an initial list of 54 items for consideration. The list was reduced to 20 items by combining, rewriting, and/or eliminating some items during the discussion phase. The missing numbers in the following list were those eliminated by the above process.

1. Distribution center for printed information (free and sales) on the travel and tourism information and resources of the area.
2. Provide information on the natural history of El Malpais.
3. Provide audiovisual programs.
4. Provide a calendar/display to advertise local events and special interest activities.
5. Interpret local archeology and American Indian lifeways.
6. Provide restrooms and associated convenience facilities for travelers.
7. Interpret resource ethics (past, present, and future) of the area.
9. Provide information on tourist accommodations and emergency services in the Grants/Milan area.
10. Interpret on-site (El Malpais) values.
12. Provide information on regional recreational opportunities.
15. Provide office/administrative space for the on-site staff only.
17. Adequate parking.
21. Provide some local day-use facilities at the visitor center site (picnic tables, hiking trail, amphitheater).
28. Interpret the area's history.
29. Provide a "welcome function" to the area.
33. Spotlight information on the national monument and national conservation area.

41. Tour-bus accessible.
43. Highly visible highway signing.
44. Computer connected with the tourism industry.
51. Develop an art (theme) mural.

Each participant was asked to select the five items of most importance to them and rank them on a scale of 1 (low) to 5 (high). The results were as follows:

Item	Ranking Points	Total
1.	4 5 5	(14)
2.	2 3 1	(6)
3.		(0)
4.		(0)
5.	3 4	(7)
6.	5	(5)
7.	1 2	(3)
9.	1	(1)
10.	1	(1)
12.	4	(4)
15.		(0)
17.		(0)
21.		(0)
28.		(0)
29.	3 4 3 2	(12)
33.	5 2	(7)
41.		(0)
43.		(0)
44.		(0)
51.		(0)

The top seven items in terms of the number of participants selecting the item and the total of the ranking points were items 1, 2, 5, 6, 12, 29, and 33.

Each participant was then asked to rank the seven selected items on a relative importance scale of 0 (low) to 10 (high). The seven items were ranked as follows:

Item	Scale Points	Total	Priority
1.	10 10 10 6	(36)	1
2.	8 8	(16)	4
5.	7 6	(13)	7
6.	8 6	(14)	5 tie
12.	5 9	(14)	5 tie
29.	6 9 7 8	(30)	2
33.	7 5 10	(22)	3

The seven items in priority order were:

1. Distribution center for printed information (free and sales) on travel and tourism information and resources of the area.
2. Provide a "welcome function" to the area.

3. Spotlight information on the national monument and national conservation area.
4. Provide a calendar/display to advertise local events and special interest activities.
5. Provide restrooms and associated convenience facilities for travelers.
5. Provide information/orientation on regional recreational opportunities (tie with preceding).
7. Interpret local archeology and American Indian lifeways.

## APPENDIX H: COMPLIANCE WITH CULTURAL RESOURCES REQUIREMENTS

### Compliance Actions

All proposed actions will comply with section 106 of the 1966 National Historic Preservation Act as amended (16 U.S.C. 470 et seq.), its implementing regulations, and applicable cultural resources legislation through NPS-28, "Guidelines for Cultural Resources Management."

Proposals in this general management plan will affect sites and areas that are on or may be determined eligible for listing in the National Register of Historic Places. To ensure that proposals for these properties comply with provisions of section 106, the Advisory Council on Historic Preservation, and the New Mexico State Historic Preservation Office have been invited to participate in the El Malpais planning process.

Representatives of the New Mexico State Historic Preservation Office (SHPO) and the Advisory Council met with staff from the National Park Service and Bureau of Land Management for briefings on the general management plan alternatives and resources management sections to give them an opportunity to understand the alternatives and to offer their comments and insights on the process.

On-site meetings at El Malpais with representatives of the New Mexico SHPO aided in evaluating the integrity and national register significance of structures and sites in the vicinity of Bandera Crater and of the multiagency center near Grants, New Mexico. Both the New Mexico SHPO and the Advisory Council will also have the opportunity to review and comment on the draft general management plan. This participation satisfies the requirements of section 106 of the National Historic Preservation Act, as amended.

Between April 1988 and February 1989, NPS and BLM planners met several times with the Acoma, Zuni, and Ramah Navajo, and contacted Laguna Pueblo as part of the public involvement process. Discussions centered around American Indian concerns regarding continued access for traditional use of resources, protection of sites, prevention of visitor trespass, and facilities development. These meetings were highly productive, contributing to

increased communication and understanding among all groups concerned.

### Basic Guidance

Basic guidance for management of the monument lies in its enabling legislation, included as appendix A, and from the general regulations that guide NPS operations and management contained in 36 Code of Federal Regulations (CFR). A discussion of the requirements of the enabling legislation is included in the "Requirements, Issues, and Concerns" section.

Relevant laws and regulations pertaining to cultural resources management are itemized in NPS-28, "Cultural Resources Management Guidelines." The NPS *Management Policies* also provide a basic summary of cultural resources management requirements. For purposes of this general management plan, the following items are deemed the most important.

**The National Environmental Policy Act of 1969** (Public Law 91-190, 83 Stat. 852; 42 U.S.C. 4321 et seq.) and its implementing regulations (40 CFR, parts 1500-1508), which direct the federal government to preserve important historic, cultural, and natural aspects of our national heritage.

**The National Historic Preservation Act of 1966 as amended** (Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470; amended by various public laws including 96-515) declared a national policy of historic preservation. Among other provisos, section 106 of this act requires that the Advisory Council on Historic Preservation be afforded an opportunity to comment on any undertaking that affects properties listed on or eligible for the National Register of Historic Places. Section 110 of this act provides that "prior to acquiring, constructing, or leasing buildings for purposes of carrying out agency responsibilities, each Federal agency shall use to the maximum extent feasible, historic properties available to the agency." Amendments to this act in 1980 stressed the responsibility to preserve and

conserve the intangible elements of our cultural heritage such as arts, skills, folklife, and folkways. **Executive Order 11593**, incorporated into NHPA by amendment, provides for federal leadership in preserving the nation's cultural environment and requires agencies to inventory cultural resources on lands under their control or affected by their programs and nominate eligible resources to the National Register.

**Protection of Historic and Cultural Properties (36 CFR 800)** gives the step-by-step procedures to be followed by federal agencies to ensure that undertakings under their control are in compliance with the 1966 National Historic Preservation Act.

Management and protection of archeological resources are more specifically outlined in

**The Antiquities Act of 1906** (Public Law 59-209, 34 Stat. 225; 16 USC. 431 et seq.)

**The Archeological Resources Protection Act of 1979** as amended (Public Law 96-95, 93 Stat. 721, 16 U.S.C. 470 aa-ii) and the implementing regulations (43 CFR 7) provide for sanctions against persons convicted of removal, defacement, and/or sale of cultural resources from federal lands. Recently enacted revisions (Public Law 100-555, 102 Stat. 2778; and Public Law 100-558, 102 Stat. 2983) to this act require that federal land managers establish programs to increase public awareness of the significance of archeological resources located on public lands. The former law also emphasizes the preservation and long-term scientific use of archeological resources, including survey of "lands that are likely to contain the most scientifically valuable archeological resources." These revisions also lower the threshold under which penalties may be assessed and require agencies to have a schedule and plan for survey of cultural resources.

**Special Directive 67-3 "Conservation of Archeological Resources"** deals with the basic dichotomy between the NPS mandate to preserve archeological sites unimpaired for future generations and the necessity to excavate sites to acquire mission-oriented

information or materials (i.e., those needed for scientific information, interpretation, or excavations that are done to rescue data that are threatened by visitor activities, natural causes, or development approved as part of the general management planning process.) This directive also stresses NPS responsibility for proper and timely curation, including provisions for adequate funding as part of projects.

Especially relevant to management of El Malpais are the various laws, rules, regulations, etc. that deal with American Indian relationships. Primary among these are

**The American Indian Religious Freedom Act**, Public Law 95-341 (92 Stat. 469, 42 U.S.C. 1996), which protects and preserves the right of American Indians to pursue traditional religious activities. As a corollary to this act, NPS Management *Policies* outline procedures for dealing with a variety of American Indian issues and require park managers to engage in the identification of and consultation with American Indian groups traditionally associated with park lands and other resources.

Staff Directive 88-I (October 13, 1988) "**Public Access to NPS Cultural Resources Management Bibliography Reports and Confidentiality of Archeological and Ethnographic Resources Information**" provides direction for review and certification of NPS bibliographic materials and outlines the provisions for protection of confidential cultural resources information, noting that federal land managers shall not make available to the public information concerning the characteristics and location of any archeological or ethnographical resources where such information release may risk harm to the resources or sites.

Other guidance is provided by

Special Directive 85-4 "Procedures for the Museum Collections Repository Western Archeological and Conservation Center, Tucson"

Special Directive 80-I "Guidance for Meeting NPS Presentation and Protection Standards for Museum Collections"

"Archeology and Historic Preservation:  
Secretary of Interior's Standards and  
Guidelines" 1983 (48 *Federal* Register 44716)

Management of Museums Act of 1955 (Public  
Law 84-127; 69 Stat. 242; 16 U.S.C. 18f)

## APPENDIX I: CULTURAL RESOURCES INVESTIGATIONS, INVENTORIES, AND SPECIAL STUDIES AND GUIDES NEEDED AT EL MALPAIS

Because El Malpais is a new area, a number of investigations, inventories, and special studies and guides are needed. These include the following:

a resources management plan (action plan) built upon the cultural and natural resources management sections of this general management plan

a cultural landscape study

a research plan

monumentwide cultural resources surveys, including archeological surveys of historic and prehistoric sites':

- . update old site forms and conduct ground-truthing of sites
- determine which rock cairns, stone bridges, and other trail elements, walls, circles, and cists are prehistoric or ethnographic and which are more recent additions by pothunters or monument managers
- . locate, document, and evaluate historic and prehistoric ways and trails across the badlands

archeological overview and assessment<sup>2</sup>

archeological evaluation study

cultural resources base map

a historic resources study

a scope of collections statement

collections management plan

collections storage plan

historic furnishings report (for interpretation of Candelaria cabin)

historic structures reports for the trading post complex and the prehistoric structures at Las Ventanas

an enhanced ethnographic program as defined by NPS-28 (2: 16, 22), which should include the following:

- ethnographic assessment<sup>3</sup>
  - . traditional [resource] use study (ethnobotanical study)
  - . ethnographic oral histories and other anthropological studies of human lifeways
  - . ethnohistory

In addition, data from these various surveys and inventories need to be included in one of several NPS-wide cultural resource inventories:

a list of classified structures, encompassing both historic and prehistoric structures

cultural sites inventory (consisting of prehistoric and historic archeological resources and contemporary ethnographic resources, as appropriate)

national catalog of museum objects, encompassing all cultural and natural history objects in El Malpais collections

1. See the previous comments in "The Plan for Cultural Resources Management" section regarding release of site-specific information.
2. Arthur Ireland's cultural prehistory study (NPS 1988a) is an excellent beginning for an expanded archeological overview/assessment.
3. The Holmes report (BLM 1989) fits most of the NPS-28 criteria for an ethnographic overview/assessment.

## APPENDIX J: CULTURAL RESOURCES RESEARCH AT EL MALPAIS

**Research Rationale.** The enabling legislation, the Archeological Resources Protection Act, and NPS policies and guidelines provide for basic and applied scientific research to support management of cultural resources. NPS-28 also describes research documents and procedures, provides technical guidance, and sets standards for research projects of all types. Research is needed to identify and evaluate important resources and develop adequate management strategies.

Resources preserved in the nation's national parks and monuments form an immense and significant research pool for scientists from many disciplines. Data gained from research in El Malpais can benefit not only the monument, the conservation area, and surrounding areas, but has far broader implications to science on a national and global scale. NPS Management *Policies* provide for NPS support and assistance to researchers doing cooperative and independent research relevant to NPS needs. Appendix 13 to NPS-53, "Special Park Use," outlines procedures for archeological research in NPS areas by qualified individuals, museums, and scientific and educational institutions.<sup>4</sup>

**Types of Research.** Several types of cultural resource research are needed at El Malpais. The first, compliance-related research, deals with the inventory, documentation, and evaluation of resources prior to development or visitor activities that will affect these resources. However, the location, scale, and type of development or use may restrict the scientific inquiry, and research may be limited to the minimum necessary to evaluate significance of a specific site or structure or to recover limited scientific data. Second, effective long-range resource management will also depend on research to identify, document, and evaluate cultural resources, establishing a comprehensive data base for El Malpais.

The last type of research, broad-based scientific inquiry, may also be done in concert with specific development, compliance, or inventory activities,

but more often it is of a thematic nature and focused upon specific, relevant research questions.

**Development of a Research Plan.** A research plan will be developed for El Malpais to generate and express the rationale behind proposed future research, including compliance activities, thematic scientific inquiry, and creation of a comprehensive cultural resources data base. The plan will define the scope, priorities, and research strategies that will be employed at El Malpais. It will also structure and guide the various activities performed during the cultural resources inventory and evaluation process, link all these activities to defined goals, and outline realistic expectations and feasible schedules.

The research plan will also integrate resource inventories and evaluations from different disciplines. It will be the vehicle to unite the various small compliance-related projects to better overall understanding of the entire monument research program; prevent cumulative impacts to sites; guide future specific research designs; and serve as an efficient and comprehensive tool to help comply with section 106 of the National Historic Preservation Act.

The plan will incorporate results of other research in the region when developing project proposals. The El Malpais research plan will be coordinated with BLM research efforts and recognize direction set by the New Mexico State Historic Preservation Office as outlined in two publications: *Prehistoric New Mexico: Background for Survey* (Stuart and Gauthier 1981), and the *Comprehensive Plan for New Mexico's Statewide Architectural Survey* (Hicks et al. 1985). The "Secretary of the interior's Standards and Guidelines for Archeology and Historic Preservation" (48 *Federal Register* 44716) and NPS-28 provide direction for identifying, documenting, and evaluating cultural resources, and for planning historic preservation in general.

Research topics relevant to the management of El Malpais may include such things as further

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4. Nondestructive archeological investigations, including use of existing collections, would be more appropriate than large-scale excavation.

examination of Las Ventanas as part of the Chacoan system; relationships between volcanic eruptions and human land use patterns, including dating of lava flows; integration of archeological data to illuminate prehistoric environmental, manipulation and specialized adaptations; definitions of special relationships among lava features and traditional uses; development of reliable cultural chronologies applicable to the El Malpais region; examination of changes in area cultures following the collapse of the Chacoan system; and determination of profiles of past environmental conditions.

## APPENDIX K: DESCRIPTION OF WORK TO BE PERFORMED BY ADDITIONAL STAFF: PREFERRED ALTERNATIVE

### Division of Management and Administration

Purchasing Agent  
GS-07 FTE 1.0

This position will be needed to prepare and process purchasing documents. An extraordinary level of purchasing and contracting will be necessary as this new area is being developed.

### Division of Visitor Services and Resource Management

Resource Management Specialist  
(Fire/Vegetation)  
GS-07 FTE 1.0

This position will be needed to continue inventory and analysis of the area's natural and cultural resources, including establishment and monitoring of vegetation transects within the monument.

Park Ranger (Interpretation)  
GS-07 FTE 1.0

This position will be needed to develop and implement interpretive programs for the east district, including the activities of the multiagency visitor center. Interpretive activities will require extensive coordination with Indian groups of the area.

Park Ranger (General)  
GS-05 FTE 3.0

These positions will be necessary to provide essential visitor services at the visitor centers. They will provide frontcountry patrol in the areas around **Bandera** Crater, the loop road, and the multiagency center.

Park Rangers (Seasonal)  
GS-04 FTE 0.5

These positions will be required to provide a full range of visitor services (such as interpretation, protection, and backcountry patrol). These positions are necessary to provide for a full-week operation with expanded hours during the months of higher visitation.

Park Ranger (Seasonal)  
GS-03 FTE 0.8

At least one seasonal will have extensive knowledge of the American Indians' perspectives of El Malpais. This individual will provide staff and visitors with an expanded awareness of American Indian issues.

Dispatcher/Clerk  
GS-04 FTE 1.0

This position will maintain radio operation at headquarters to monitor routine and emergency communications with the field. This individual will also provide routine preparation of reports, time cards, and correspondence for the division.

## Division of Maintenance

Maintenance Mechanic  
(Buildings & Utilities)  
WG-09 FTE 1 .0

This position will be needed to maintain the facilities and infrastructure at the multiagency center and the Bandera visitor center. The employee will also service buildings and utilities at the employee housing complex.

Maintenance Worker  
WG-05 FTE 1 .0

This position will be necessary to perform inspection and general maintenance of facilities at East Rendija, El Calderon, the Bandera Crater area, and the west half of the Zuni-Acoma Trail. The individual will also perform campground and trail maintenance in the west district.

## APPENDIX L: ESTIMATED CLASS "C" CONSTRUCTION COSTS

### PREFERRED ALTERNATIVE

Description	Gross Costs (in thousands)
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#### Multiagency Center

New orientation center	\$2,184
Paved parking	89
Paved entrance road	234
Telephone/electric	61
Sewer/water	546
Trail	32
Intersection improvements	11
Landscaping/site development	214
Signs	<u>8</u>
<b>Subtotal</b>	<b>\$3,379</b>

#### Bandera Crater/Lava Crater Area Buildings

New Visitor Center	\$2,340
Rehabilitate trading post	117
4-bay maintenance building	684
4 single-family residences	624
4-unit seasonal employee apartment building	<b>262</b>

#### Parking

Paved maintenance yard	47
Paved residential parking	16
Paved visitor center parking	97
Trading post parking	99
Paved Dripping Lava Cave parking	<b>30</b>

#### Roads

Paved entrance road	819
Paved tour road	2,184
Paved maintenance/residential road	624
Paved Dripping Lava Cave road	351

#### Trails

Visitor center nature trail	32
Lava surface features trail	56
Ice Cave trail	35
Bandera Crater trail	30
Bandera Crater connector trail	32
Dripping Lava Cave trail	16
Lava Crater trail	17
Sandstone Ridge trail	115
Sandstone Ridge connector trail	45
Trail inside Dripping Lava Cave	20

Spattercone Valley connector trail	36
Cerro <b>Bandera</b> summit trail	42
Cerro <b>Bandera</b> connector trail	49
Spattercone Valley trail	47

#### Utilities

Telephone/electric	211
Water system (well, tank, system)	936
Septic system	<u>133</u>

#### Miscellaneous

Stairs at Ice Cave	47
Handicap <b>viewdeck</b> at Ice Cave	32
Stairs at Dripping Lava Cave	47
Maintenance yard fence	9
View deck at visitor center	23
Intersection improvements	156
Landscaping, site development	537
Signs (road, directional)	31
Remove noncontributing existing structures	31
Other walks and paths	17
Rehabilitate borrow/cinder pits	312
Picnic area	<u>6</u>
<b>Subtotal</b>	<b>11,392</b>

#### East Rendija Area

Gravel, new county road 42 realignment	1,248
Gravel, improve other parts of County Road 42	624
Obliterate and restore 2 miles of County Road 42	78
Gravel spur road to Cerro <b>Bandera</b>	63
Gravel parking at Cerro <b>Bandera</b>	8
Gravel spur road to primitive campground	312
Campground, primitive	72
Vault toilets in campground	32
Gravel parking at lava wall trailhead	8
Loop trail at lava wall	42
Gravel parking at East Rendija	19
Trail to Big Skyline Cave, Four-Window Cave	44
Trail to Caterpillar Collapse, Seven Bridges	22
Vault toilets at trailhead	32
Intersection improvements at NM 53 junction	16
Landscaping, revegetation	16
Signs	3
<b>Subtotal</b>	<b>2,639</b>

<b>Braided Cave</b>		Intersection improvements with NM 117	8
Dirt parking area and gate	6	Landscaping	5
Trail to Braided Cave	32	Signs	<u>24</u>
Revegetation	2	<b>Subtotal</b>	2,353
Signs	2		
<b>Subtotal</b>	42	<b>The Narrows</b>	
<b>El Calderon Area</b>		New paved spur road	58
Gravel existing El Calderon road	468	Paved parking	13
Gravel road Junction Cave		Handicap-accessible trail to overlook	19
to Bat Cave trailhead	283	Loop trail to lava surface features	22
Gravel parking at Bat Cave trailhead	19	Intersection improvements with NM 117	8
Vault toilets at trailhead	32	Landscaping	5
Bat Cave trail	16	Signs	<u>16</u>
Parking lot/Double Sinks/Junction Cave trail	11	<b>Subtotal</b>	141
Gravel parking at Junction Cave	7		
Obliterate, restore El Corral road (3 mi)	119	<b>McCartys Crater Viewpoint (option #1)</b>	
Obliterate, restore Bat Cave road (1 mi)	39	Paved spur road	117
Intersection improvements at NM 53 junction	16	Paved parking	13
Design viewing area	1	Trail to viewpoint	16
Landscaping	8	Intersection improvements with NM 117	8
Signs	<u>24</u>	Landscaping	5
<b>Subtotal</b>	1,043	Signs	<u>16</u>
		<b>Subtotal</b>	175
<b>Zuni-Acoma Trail</b>			
Pave two existing gravel parking spaces		<b>NM 117 Orientation Kiosk</b>	
for handicapped	3	Pave roadside parking	10
Obliterate, restore two parking spaces	3	Signs	<u>16</u>
Realign, make handicap-accessible trail		<b>Subtotal</b>	26
to viewpoint	3		
<b>Subtotal</b>	9	<b>Summary Subtotals</b>	
<b>Acoma-Zuni Trail (if easement acquired)</b>		Multiagency center	3,379
New paved spur road and parking	105	Bandera Crater/Lava Crater area	11,392
Intersection improvements	8	East Rendija area	2,639
Landscaping	4	Braided Cave area	42
Signs	9	El Calderon area	1,043
Connecting trail	<u>5</u>	Zuni-Acoma trail	9
<b>Subtotal</b>	131	Acoma-Zuni Trail	131
		Sandstone Bluffs/Las Ventanas	2,353
<b>Sandstone Bluffs/Las Ventanas</b>		The Narrows	141
Realign and pave road to		McCartys Crater viewpoint	175
Sandstone Bluffs	1,989	NM 117 orientation kiosk	<u>26</u>
Pave new Las Ventanas spur road	117	<b>TOTAL</b>	<b>\$21,330 *</b>
Pave parking at Sandstone Bluffs	52		
Pave parking at Las Ventanas	13		
Obliterate, revegetate 10 parking spaces			
at Sandstone Bluffs	16		
Trail to Las Ventanas	52		
Trail, handicap-accessible at			
Sandstone Bluffs	14		
Handicap-accessible vault toilet	47		
Overlook deck	13		
Lockable entrance gate	3		

\* Does not include Harpers Ferry Center costs for interpretive media in visitor center or for wayside exhibits

**MINIMUM REQUIREMENTS ALTERNATIVE****Multiagency Center**

New orientation center	2,184
Paved parking	89
Paved entrance road	234
Telephone/electric	61
Sewer/water	546
Trail	32
Intersection improvements	11
Landscaping/site development	214
Signs	8
<b>Subtotal</b>	<b>3,379</b>

**Bandera Visitor Center**

Realigned and paved entrance road	936
New visitor center	2,340
Rehabilitate trading post	117
Paved parking	122
Telephone/electric	121
Septic system	67
Water system	500
Remove noncontributing structures	31
Intersection improvements	156
Obliterate, restore road	40
Paved maintenance road	624
4-bay maintenance building	684
Paved maintenance yard parking	47
Maintenance yard fence	9
4 single-family residences	624
4-unit seasonal employee apartment	262
Paved residential parking	16
Ice Cave trail	35
Stairs at Ice Cave	47
Handicap viewdeck at Ice Cave	32
<b>Bandera Crater trail</b>	<b>30</b>
<b>Bandera Crater connector trail</b>	<b>32</b>
Trail to Dripping Lava Cave	6
Lava surface features trail	56
Other walks and paths	17
Rehabilitate borrow/cinder pits	312
Landscaping/site development	400
Signs	2 5
<b>Subtotal</b>	<b>7,688</b>

**El Calderon**

Designate bat viewing area	<u>1</u>
<b>Subtotal</b>	<b>1</b>

**Braided Cave (no new development)****East Rendija (no new development)****Zuni-Acoma Trail (no new development)****Acoma-Zuni Trail (if easement acquired)**

Paved spur road and parking	105
Intersection improvements	8
Landscaping	4
Signs	5
Connecting trail	<u>5</u>
<b>Subtotal</b>	<b>131</b>

**Sandstone Bluffs/Las Ventanas**

Realign existing gravel road	40
Redesign parking	19
Handicap-accessible trail to overlook	14
Overlook deck	13
Lockable entrance gate	<u>3</u>
<b>Subtotal</b>	<b>89</b>

**NM 117 Orientation Kiosk**

Paved roadside parking	10
Signs	<u>16</u>
<b>Subtotal</b>	<b>26</b>

**TOTAL 11,314**

## APPENDIX M: PRINCIPAL LAVA FEATURES IN THE NATIONAL MONUMENT

Following are definitions of the more common surface and subsurface features in the lava flows of El Malpais National Monument, particularly the features present on the youngest **Bandera** and **McCartys** flows that are the least weathered and most easily interpreted to the public.

At El Malpais there are three structural/textural varieties of lava surfaces. These are common around the world in volcanic rocks of basaltic composition (the names of the first two types are words of Hawaiian origin):

**pahoehoe** – relatively smooth surface, sometimes almost pavement-like, but usually with undulations, sinuous folds, and densely clustered **ropelike** structures that show how the fluid lava solidified. This type of lava is the easiest to walk on.

**aa** – irregular surface composed of rough broken masses and often jagged spinous pieces of lava that are mostly a foot or less in diameter. Along with many fissures, these features make **aa** lava very difficult to walk on.

**blocky** – extremely irregular surface with large angular rock masses typically exceeding a foot in diameter, and sometimes exceeding 6 feet. Blocky lava is a tortuous “up and down” terrain, exceedingly slow and difficult to traverse.

All three types are common in the **Bandera** flow where they are frequently observed in close proximity. By far, the most common type in the **McCartys** flow is pahoehoe, which makes accessible parts of this flow comparatively easy to traverse, except in areas where there are large sags and pressure ridges.

**Spattercones (hornitos)**, well-represented on the **Bandera** flow, are formed when fluid lava beneath a hardening surface is ejected upward through holes and builds up towerlike structures. These structures are typically composed of small hardened blobs of lava, and they may be semihollow and interlaced with miniature lava flows, holes, and windows; they often have interesting dripping-lava textures.

**Tree molds** form when lava engulfs a tree or log and the wood burns out rapidly, leaving cylindrical holes in the flow surface. Tree molds are known on both the **Bandera** and **McCartys** flows, but are particularly common near **Bandera** Crater where there is a very unusual tree-trunk squeeze-up (Lindsey 1949a).

**Squeeze-ups** form when viscous lava is extruded through an opening in the solidified crust (Nichols 1939,421). Nichols identifies two types common in the **McCartys** flow: bulbous squeeze-ups representing upward extrusion of lava through vents on the flow, resulting in knobby and **bulblike** structures, and linear *squeeze-ups* representing upward extrusion of lava along cracks. (The linear type is frequently in the form of long, wedge-shaped masses up to a few feet high along the centers of widely opened crevices, and they may show vertical grooves and flutes.) Many fragments of *grooved* lava common to the ruptured pahoehoe crusts of the **McCartys** flow are attributed by Nichols (1938, 609) to the squeeze-up phenomenon. Squeeze-ups are present, but not nearly as common, in the pahoehoe surfaces of the **Bandera** flow.

**Pressure ridges** common to the **McCartys** pahoehoe flow, and less common in the **Bandera** flow, are formed when the movement of the flow beneath the surface continues and the more rigid hardened crust above buckles into elongated ridges and splits. The axes of these ridges are oriented either parallel or transverse to the direction of flow.

**Surface sags and sinks** developed in both the **Bandera** and **McCartys** flows in spots where fluid lava drained out from below and the hot, semiplastic crust drooped into the resulting voids. In some places these voids were so large that the entire surface fragmented and fell into collapse depressions. In the **Bandera** flow, several such depressions are truly enormous. Where large subterranean lava tubes or groups of tubes collapsed, parallel-walled collapse structures were formed.

**Lava walls** refer to places along flow edges where the lava was sufficiently viscous to build up to a considerable height – in places 70 feet above the adjacent terrain.

**Kipukas** (a Hawaiian term) are hills to slight swells that were surrounded by lava flows. Thus, kipukas are islands of older terrain within lava flows. They vary from very small to hundreds of acres, and they are found by the dozens in the McCartys, **Bandera**, and older flows. Kipukas commonly have vegetatively rich lava-edge ecotones, and because some have underlying rock other than lava and have been isolated from access by wildlife, livestock, and humans, they may be islands of unusual biologic composition or diversity.

The origin of large and extensive systems of **lava tubes** and the interesting diversity of rock structures and textures related to them, is discussed in the "Affected Environment" section on geology. (Lava tubes are also called lava caves.) However, it is important here to distinguish between the deeper tubes that drained the center of an entire solidifying lava flow and much smaller tubes, termed **surface tubes**, that are common on pahoehoe lava surfaces and are only of local extent. Surface tubes may be a few feet to only inches in diameter, are seldom more than a few dozen feet long, and are often sinuous and break into miniature lava flows of very interesting shape. Surface tubes are very common on the pahoehoe flows in the vicinity of **Bandera Crater**.

**Ice caves** in El Malpais are simply portions of lava tubes near or beneath the groundwater table that are of the requisite configuration and depth to capture winter air and maintain subfreezing conditions through the warmer seasons. Lava rock is a superb natural insulating material, and there are well over a hundred caves and deep crevices in the **Bandera** and other flows that contain year-round ice. Some of these caves contain floors and walls of ice, ice crystals and "blades," icicles, and ice "bats" or stalagmites. Because the entrances to ice caves are cool throughout the warmer growing season, some support concentrations of ferns, mosses, lichen, and algae that would not otherwise be common at this elevation and latitude. It should be noted that prehistoric human use of El Malpais flows is commonly associated with sources of water and ice. Therefore, archeological sites may be dense where ice caves and icewater springs occur in tubes and sinks in the lava.

## APPENDIX N: MORE DETAILED INFORMATION ABOUT **BANDERA** CRATER AND THE **BANDERA** LAVA TUBE SYSTEM

The actual sequence of volcanic events in the development of **Bandera Crater** is complex and not agreed on by geologists. Hatheway and Herring (1970, 308) list several separate events, in summary including the following: extrusion of **aa** flows including local spattercone activity; formation of **Bandera cone** followed by breaching on its southwest side; eruption of thick pahoehoe flows (through the breach) that flowed for miles and produced the **Bandera lava tube systems** (followed by the recession in the throat of the volcano); and eruption of local **aa** flows from fissures in some of the earlier flows.

The **Bandera** lava field, with numerous craters and flows in the national monument, appears to lie at the intersection of two major and deep-seated "lineaments" or long zones of weakness in the earth's crust, which had their origins in ancient pre-Cambrian time. One zone, the **Jemez lineament**, extends from east-central Arizona across New Mexico to Taos – and perhaps beyond to the Clayton Area in northeastern New Mexico. This lineament seems to be the zone along which several of northern New Mexico's famous lava fields originated. The other zone, the **Zuni-Sacramento lineament**, extends from the Texas line north of El Paso northwesterly to the high plateaus of Utah. Reactivation of these two zones in comparatively recent geologic time, including the resultant eruption of volcanoes at their intersection in the northwestern part of the national monument, makes El Malpais an important area for future research.

Hatheway and Herring (1970) note that most tubes are formed entirely under pahoehoe surfaces. In some situations, an open lava channel may develop a crust while the flow continues beneath, creating a circular tube that may remain intact after the fluid lava drains. This results in tubes that are at most a few hundred feet long, but it does not adequately explain the extremely long tube systems characteristic of the **Bandera** field. The explanation favored by Hatheway and Herring is that cylindrical bodies of more fluid lava, narrow but quite long, developed along the axis of the flow. These cylinders may then have ruptured down flow, forming new extensions of the flow front, and as

long as a supply of lava kept draining through these cylinders, they fed the new flow fronts downstream. When the lava supply ceased, the cylinder drained to form an open tube. Other details of tube formation are reserved to technical literature.

The 14-mile section of the **Bandera** flow that **Carlton** explored for lava tubes in 1988 begins at an elevation of about 7,900 feet at **Bandera Crater** and descends to an elevation of about 7,200 feet. The beginning of the system immediately below the crater may be an "volcanic canyon" rather than having been a roofed tube, but within 1 mile of the crater the system begins to assume a discontinuous subterranean character. The tube system is actually much longer than its estimated axial extent of explored distance, some 14 miles, because of several shorter tributaries that join at various angles to the main channel. Also, the lower extremities of the system branches complexly. Less than 20 percent of the system is in the form of caves that are actually enterable. Some sections show surficial evidence of tubes highly indicative of caves beneath, but they cannot be entered for various reasons, including the surface having been overrun by later lava flows. In other sections, the tube alignment is amorphous and shows no surface expression, if indeed it exists at all. Other sections are elongated pits, which are segments of former tubes that collapsed. (Of this phenomena, Hatheway and Herring note that "tube failure began almost immediately after formation and . . . portions of the tubes underwent complete collapse in periods as short as a few weeks" (1970,317). Despite all these discontinuities, the system contains unbroken tubes up to 3,000 feet long and other tubes approaching 7,000 feet that are breached at only a few intervals by short collapse structures. The combination of subterranean passages with open "windows" and larger collapse structures greatly varies the exploration experience along the tube system. These combinations also offer a notable contrast to other such lava tube systems in the national park system.

In addition to what is said about the lava tubes in the main portion of this document, **Carlton** found that nearly all the lava tubes have ceilings developed immediately below classic pahoehoe

flows. Some ceilings sag, some are upraised in bubblelike or domelike structures, and some are incredibly thin and in places have broken through to make “windows” in the ceilings. The lava tubes in the upper 6 miles of the flow have experienced considerable ceiling breakdown (not necessarily “breakthrough”) and are strewn with piles of angular boulders. Although this condition in caves is common in other portions of the **Bandera** system, it is the lower two-thirds of the **Bandera** tube system that exhibit sections of floor with smooth pahoehoe surfaces. It is also in the middle to lower part of the **Bandera** system that long, continuous stretches of tubes with “classic” oval to circular cross sections are found. These are often really tubelike, with smooth, rounded ceilings and walls, and with floors that may be occupied by shallow pahoehoe flows. In some caves, these “floor flows” subsided in the middle, leaving higher “lava trough” structures along the flow margins. Some passages have one or more lava “curbs” on their sides – long ledges that mark falling levels of molten lava. In other cases, the mid parts of the floor flows are raised compared to the margins.

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